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ABSTRACT

This study examined students' experiences of university medical education, approaches to learning, and comprehension of learning tasks. It used semi-structured interviews with 60 preclinical and clinical medical students. Half of the students attended Gothenburg University (Sweden), which employed a conventional discipline-based curriculum, while the other half attended Linkoping University (Sweden), which employed a problem-based learning (PBL) curriculum. The results indicated that PBL students seemed to have experienced a more flexible, meaningful, and enjoyable education compared with their counterparts from the traditional program. PBL students showed an inclination toward adopting comprehension approaches both in general and to specific learning tasks, whereas the conventional students' propensity was toward reproductive strategies. As regards the students' comprehension of learning tasks, the results indicated that the students from both programs performed more or less equally. Appendices outline the course of study for medical students at Linkoping University and Gothenburg University. A list of Linkoping Studies in Education and Psychology is also included. (Contains 139 references.) (MDM)

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PROBLEM-BASED AND CONVENTIONAL MEDICAL EDUCATION FROM A STUDENT PERSPECTIVE

A qualitative analysis comparing students' experience of medical education, approach to learning and reading comprehension

Ameneh Rahimi

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Akademisk avhandling

som med vederbörligt tillstånd av filosofiska fakulteten vid Linköpings universitet för avläggande av filosofie doktorsexamen kommer att offentligt försvaras på institutionen för pedagogik och psykologi, Eklundska salen, torsdagen den 21 september 1995, kl 10.00.

The study is primarily an empirical investigation to students' experiences of university education, approaches to learning and comprehension of a learning task. Sixty medical students, equally distributed over a PBL and a traditional medical school have participated in this study. Data consist of semi-structured interviews, which have been analyzed mainly using a phenomenographic approach, i.e., the aim has been to establish a set of categories for the description of differences in conceptions expressed by the participants.

The results showed that PBL students seem to have experienced a more flexible, meaningful, and enjoyable education compared with their counterparts from the traditional program.

The domain of learning approach comprise both approach to a specific learning task as well as approach to learning in general The results in this section indicate that PBL students showed an inclination towards adopting comprehension approaches both in general and to the specific task, whereas the conventional students' propensity was towards reproductive strategies.

As regards the students' comprehension of the learning task, the results indicated that the students from both programs perform more or less equally. Thus, the results appear to be, somewhat paradoxical. It was hypothesized that using a comprehension-oriented approach would yield a better understanding of the learning tasks. Our results did not support this assumption. To understand why this was not the case several explanations seemed plausible. Among many other things, it seems to be difficult to put into practice a PBL-curriculum in a setting which originally did not encompass PBL supportive characteristics.

One conclusion that can be drawn from the results is that when students enter different programs they can still maintain their approach to learning even if they report differently about their experience of studying.

Key words: Problem-Based Learning (PBL), medical education, learning approach, learning outcome, attitudes, experimental design, qualitative analysis.

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Chapter 1

INTRODUCTION

The medical curriculum: Traditional and Problem-based learning

> In medical education teaching takes the various parts as starting points, i.e., it starts with the details. Yet, there is a general belief that in the end the qualified doctor is there with all the parts put together, comprehensible and applicable in a real context. The training is to a much too large extent a question of learning to find out what the teacher wants you to know, rather than being a question of learning by interest. Theory is often poorly connected with the clinical reality where knowledge and skills are to be brought to practical use. The medical student is often passive and takes little responsibility for his own learning. Doctor trainees get a substantial background in natural sciences and biochemistry but a negligible frame of reference in behavioural and social sciences, or none at all. Creativity and critical thinking are not developed during medical training. The importance of vast knowledge of isolated facts is exaggerated and the usefulness of understanding processes and complex relations is underestimated (Boethius, 1981).

The quotation presented above was chosen because it contains the nature of complaints about a so-called conventional or traditional medical curriculum, abundant examples of which are found in different medical journals or other related materials (Miller, 1962; West, 1966; Gonella et al., 1970; Levin & Forman, 1973; Maddison, 1978; Eichna, 1980; Anderson & Graham, 1980; Dornhorst, 1981; Bock, 1984; Awbrey, 1985; Smith, 1985; Warren, 1988).

The term 'traditional medical curriculum' refers to the medical curriculum with the following characteristics: a 2 to 4 year period of pre-clinical study (courses in the basic sciences), followed by a 2 to 4 year period of clinical training. The pre-clinical education depends largely on lectures and textbooks. During the period of clinical education, it is required that students learn to apply their knowledge effectively in a clinical context.

What appears in these comments, as in many others, is that traditional medical education is regarded as very demanding. It seems to put a heavy burden on students to retain knowledge that they acquired during their studies of basic sciences until it is needed in clinical work. The student appears to be poorly motivated and tends to see education as a frustrating ordeal to be carried out rather than an exciting experience.

However, I do not intend to further the discussion about the rights or wrongs of the conventional medical curriculum, because too much has been written on this subject. The rest of this chapter will include a short overview on how and why it came into being, and its distinguishing features. Afterwards, the reasons why it has been challenged and some of the

measures taken to do so, will be discussed. This chapter will further include a brief introduction of Problem-Based Learning (PBL), one of the suggested alternatives to the traditional curriculum. The general purposes of the present study and a plan of the structure of the work constitute the final part of this chapter.

A historical background

Medical education has undergone many changes during the last century. In medical education, as in other lines of education, one can trace different aims behind initiatives for curriculum changes. These aims are themselves determined by different factors. The forces behind curriculum changes or the forces which challenge the validity or relevance of any particular existing curriculum can be of differing nature.

Medical education is no exception to this rule. Alterations in the notion of learning, knowledge, as well as changes in political and socio-economic conditions, are among the variables, which with varying impact, have determined from time to time, what should be planned, taught and learned in medical schools. It is worth mentioning that much of the efforts made for the advancement of the medical education in the present century is concentrated to the United States and Canada.

Balla (1989) describes how throughout history the concept of a physician and his education has evolved in response to prevailing social forces and the contribution made by several people, i.e. Flexner (1910), Foucault (1973), Friedson (1971) and Starr (1982) to the improvement of medical education, and concludes that:

> We have traced the development of the clinical professional from his origins in sorcery, through the use of the clinical gaze, with increasing insight into the underlying pathological processes that give rise to the complex of symptoms which bring the patient to seek help from his doctor. There evolves a doctor well tutored in science, so that he can now gain a better understanding of disease and can offer help as needed. With this come increasingly costly methods of data acquisition (ibid. p. 7).

Among the contributors mentioned by Balla, I will focus on Flexner's contribution and his influential report published in 1910, not because the others are less important or less original but because Flexner's is most visible. This report is of significant importance in at least two respects. It was not only the turning point in the history of medical education on which most subsequent medical education was founded, but it also established a scientific benchmark against which all programs of medical education were to be measured.

It must be noted that Flexner's vision, in turn, was influenced by John Hopkins Medical School established in 1893 which provided guidelines for

the then existing medical schools. Regarding this issue as well as who Flexner actually was, Kendal and Reader (1988) write:

> Shortly after John Hopkins opened, its faculty, along with their counterparts in other elite medical schools, joined with the Council on Medical Education of the American Medical Association to sponsor an evaluation of medical schools in the United States and Canada. They approached the Carnegie Foundation for the Advancement of Teaching; in turn, the Foundation provided funds so that Abraham Flexner a secondary school teacher, could study a sample of existing medical schools (ibid. p. 280).

This report contains some remedies for the improvement of the medical curriculum which were then considered to be very effective, some of which still are effective if applied accordingly. Central to Flexner's reformist measures is that medical education should be divided into two distinct parts; a theoretical part which consists mainly of basic science course work, positioned in the early phase of the education, and a practical part which comes right after, and constitutes the latter part of it. The laboratory was considered, by him, to be the main learning context in which the theory part should be taught and the lecture format was regarded as a supplementary means in educating medical students. Put differently, he delineated both the core content of the medical curriculum (understanding of the principles of basic science and scientific methods) as well as the method of instruction (in the laboratory setting by carrying out experiments in combination with the traditional lecture format) in a university setting.

Flexner emphasized the fact that medical students should have a firm scientific base before starting clinical training for two reasons. First, provided that the Flexner era was occasioned by an increased interest in science in general, scientification of the medical education seemed appropriate to tackle medical education deficiencies. Secondly, he had a strong personal belief in the significant impact of the biomedical knowledge on the well-being of the nations of the world.

The Flexnerian curriculum was recognized by many educators as the single, universally applicable model. This recognition was reinforced particularly after World War II, when both private foundations and the National Institute of Health tended to endorse Flexner's recommended curricular structure by targeting members of specialized departments and rewarding research in the basic and applied biomedical sciences. Ebert and Ginsberg (1988) refer to this period as *'a period characterized by liberal support for research training'* (ibid. p. 15). Ironically, this led to unanticipated consequences which contributed to decreasing the quality of medical education in two ways; 1) strengthening individual departments fuelled the dissemination of departments' expertise through department-controlled curricular time and 2) slanting gradually the direction of interest toward research and away from educational issues.

The latter, in turn, laid the early foundation for the erosion of interest in the educational issues among the teachers, something which continues to

be true today; not surprisingly when talking to the teachers, they would say, *'there is neither merit nor money for people who are engaged in educational issues. All the credit both financially and academically, go to those individuals or individual departments who have more publications not to those who are committed to the educational issues.'* (Author's interview with medical teachers). Or students would say, *'teachers are not interested in teaching us, they are more engaged in their research.'* (Author's interview with medical students).

In this way, the Flexnerian medical curriculum laid the essential foundation of the curriculum which has been implemented throughout the world for more than eighty years and which is now known as the traditional or conventional medical education.

The degree of congruence between the measures taken in putting into practice Flexner's ideas and the intent of his curriculum to overcome medical education difficulties has gradually become lower and lower over time, due, among many other things, to the ever-increasing interest among people in studying medicine, the costly nature of the education, the rapid expansion of the biomedical knowledge and the limited amount of time.

What then remains of the Flexnerian curriculum, is, to a large extent, a separation of the theoretical and practical phases of the education, having firm basic science information as essential knowledge (which can have varying definitions in different hands), and lectures as the dominating and - too often - the only means of educating medical students.

The turn of the tide

Since the early 1950s the tide in medical curriculum studies started to turn again. New trends have tried to challenge the Flexnerian curriculum.

The expansion of scientific knowledge and technology, the rise of new ethical questions, the uneven distribution of the opportunity of receiving health care service within society, treatment-oriented and highly specialized practice of medicine, the failure of biomedical science in alleviating all existing ailments, paralleled with a dramatic evolution in the concept of learning and the view of knowledge, all which resulted in the inception of new demands which, it was assumed, traditional medical education could no longer be responsive to. To be able to meet the existing as well as prospective requirements, a doctor should possess some characteristics which, it is believed, have not been emphasized sufficiently in that kind of curriculum.

This new way of looking at learning and the new perspective on knowledge accompanied by the changes mentioned above acted as guidelines in the new movement in curriculum research and the determination of the measures taken for the improvement of medical education.

The intention of the new movement did not simply focus on responding to the health needs and demands of the population on the basis of which

the medical curriculum is to be defined, however; it also took into account many other significant aspects of educational activities in general, and university education in particular, which either had not been recognized or their importance not fully realized, in the earlier educational planning for physicians. The interdependency between the education and training of professionals and delivery of medical services is expressed by Ebert and Ginzberg (1988) as follows:

> The quantity and quality of professional services to the public depend, first, on the education and training of professionals and, second, on the ways in which a society organizes its delivery of services. Education and service delivery are highly interdependent in the medical arena because of the dominant role of the physician, who has primary responsibility for diagnosis and therapy (ibid. p. 6).

The new concept of learning and perspective of knowledge and its relation to higher education, of which medical education is a part, will be discussed later in chapters 3 and 4.

Since as early as 1946, many attempts had been made by curriculum developers to change the existing structure of medical education. Some of these were short-lived and some longer-lasting reforms and ranged from updating the content of basic science lectures, introducing pathophysiology into the undergraduate curriculum to introducing behavioural science courses. Among the more comprehensive curricular revisions, the following are of particular importance.

In the 1950s, Cornell University and the University of Colorado introduced the 'Comprehensive Care Programs' designed, to expose final year medical students to primary, continuous care of patients and their families. At about the same time, Case Western University School of Medicine attempted to teach basic medical sciences in an integrated fashion by introducing vertical and horizontal integration into its curriculum (Ebert & Ginzberg, 1988).

With the lecture format as the main method of instruction supplemented by multidisciplinary laboratories, studies were organized according to the body's organ systems rather than basic science disciplines.

Horizontal integration was achieved by co-ordinating and applying relevant pre-clinical basic science information (anatomy, microbiology, cell biology, etc.) to the organ system under study, i.e., the nervous system.

Vertical integration, i.e. integration of the basic and clinical sciences (dermatology, internal medicine, etc.) was achieved by participation of both clinicians and basic scientists in the teaching of different organ blocks. The intention was to minimize redundancy of the curriculum, increase students' motivation to learn basic science by showing the relevance of basic science to the clinical context, and improve students' basic science knowledge retention. This type of integration was later adopted by several other medical schools. These innovative programs were discussed extensively by Kendall and Reader (1988).

The trends in curriculum development are probably spread all over the world, and the opinion that there was a need at times far-reaching changes in medical education grew ever stronger, after the triggering event of establishing a Problem-Based Learning (PBL) curriculum at McMaster University in Hamilton, Canada, in 1968. This pre-clinical curricular structure, was offered as a major attempt to tackle the traditional curriculum crisis. Luckily, its validity and contemporary relevance was endorsed and strengthened by influential organizations such as the World Health Organization (WHO) and related associations such as the Network of Community-Oriented Educational Institutions for Health Sciences and Association of American Medical Colleges (AAMC), as there was a high degree of congruence between their goals.

Problem-based learning since its establishment as a pre-clinical curriculum at the McMaster University, gained popularity in the medical education community. Many medical schools throughout the world adopted this approach, either within existing conventional curricula, or at newly established schools. The University of New Mexico and the College of Human Medicine at Michigan State University are examples of the former, with both innovative and traditional programs. The University of Limburg, Maastricht, in the Netherlands and the University of Newcastle in Australia belong to the latter category.

The Linköping Faculty of Health Sciences (FHS) in Sweden can be placed somewhere in between the two categories mentioned above. Before the adoption of a PBL in 1986, the then Linköping medical faculty together with Uppsala University had a joint responsibility for educating medical students in that the students who were accepted for the study of medicine at Linköping University spent the pre-clinical part of their education at Uppsala University and then continued at Linköping. In 1975, the pre-clinical education was added to the pre-existing clinical education. Since 1986, a full scale PBL program has been implemented at the Linköping Faculty of Health Sciences. (for detailed information regarding the development of the Linköping Faculty of Health Sciences (FHS), see Bergdahl et al. (1991).

General purpose

This study is a systematic effort to investigate the impact of PBL, as regards obtaining a more comprehensive understanding of the way in which students perceive their curriculum, approach to learning tasks, and the learning outcome compared with their counterparts in a traditional program.

The founders of PBL believe, among many other things, that this method encourages meaningful learning among the students (Barrows & Tamblyn, 1980) a kind of learning which promotes understanding of the principles and complex relations within medical knowledge or any kind of

knowledge, for that matter. Contributory prerequisites to do so is the possession of a kind of cognitive skill or, as Marton and Säljö (1976; 1984) termed it, a deep approach and its application to the learning tasks.

University education in general, and medical education in particular, can and should cultivate this type of cognitive approach and consequently meaningful learning among their students. This is of particular interest because students with these learning characteristics have better knowledge attainment and, ultimately, are more successful in academic achievement (Svensson, 1977).

The effect of the educational context and its influence on students' attitudes towards their education has a history as long as education itself. Its significance, however, has been subject to investigation by many educational and psychological researchers in recent decades. Put differently, the above mentioned issues, in turn, are effected by students' perceptions of educational context and the opportunities they perceive are provided for them by this context (Ramsden, 1984). In other words, the educational context is a guideline for the students for how to approach the learning tasks and the latter determines the quality of the learning outcome.

Cultivation of a deep approach as well as a better understanding of the learning materials among the students, the proponents of PBL claim, are, objectives, which this innovative curriculum would bring about. Furthermore, they believe that PBL creates a learning atmosphere in which the learning process is more enjoyable. It is therefore of great interest to see to what extent students from PBL and traditional schools of medicine differ from each other, as far as their perceptions of medical education, approaches to learning as well as learning outcomes are concerned. The primary aim of the study is, thus, to illuminate the following issues:

1. Students' experience of medical education.

2. Students' general approach to learning.

3. Students' approach to and their comprehension of a learning task (scientific article).

Conducting a study of this kind might be beneficial for many reasons. Its immediate obviously informative benefit is directed towards the two people engaged in educational planning at universities whose students participated in this research. The results are no less important for the students who are the main target group in any educational setting. The findings can be of particular interest to PBL students because, after all, they are the target group of the innovations. Furthermore, they may also, hopefully, be useful for other medical educators who are interested in the development and refinement of medical education.

Among a number of studies concerning evaluation of different educational outcomes of PBL, no one single study has been designed in such a

way that its measuring tools are consistent with the objectives PBL are expected to foster in the students, i.e. qualitative aspects of their ways of learning. Curriculum study is hazardous as it is due, among many other things, to the obvious technical problems in designing such studies. Insensitive selection of the measuring instruments would only compound the problems.

Disposition of the thesis

The study is divided into sixteen chapters. Following this introduction, the historical origins of PBL, some of the theoretical bases, characteristic features and its educational objectives are discussed. Chapter three contains a review of investigations into the effects of higher education. Comparative studies on students' conceptions of the curriculum, approach to learning as well as academic achievements are summarized in chapter four. The research perspective on which this study is based is presented in chapter five. The educational context makes up the content of chapter six. In chapter seven, the design and method employed in gathering the empirical data and information for the work are described. Chapter eight to fifteen comprise the results of interviews. The results are summarized and discussed in chapter sixteen.

Chapter 2

PROBLEM-BASED LEARNING IN MEDICAL EDUCATION

Historical background and theoretical foundations

As was mentioned in chapter 1, over the last fifty years there has been widespread concern that medicine and medical education are no longer responsive to the needs of society at large. The former mainly concentrated on hospital care and technology and ignored the emotional needs of the individuals and the needs of the community in which he or she lived. Furthermore, the general education of the physician consisted of conventional lectures, fixed curricula and passive learning considered to be incongruent with both the accepted principles of learning and the goals of higher education.

These resulted in calls for physicians who practice preventive and primary care oriented medicine. Physicians who are not only knowledgeable through being lifelong self-directed learners (the concept 'self-directed learning' will be discussed in more detail in the last part of this chapter) but more important, treat their patients in a holistic, humanistic and cost-efficient manner. These are the characteristics which are believed to have been insufficiently emphasized in traditional medical education.

Several attempts were made as a response to these needs by the medical education community. Among medical educators who tried to make an improvement in the medical curriculum during the 1960s Howard Barrows was one of the more visible and gained a special position. As an academic neurologist, he developed an instructional approach which is known as a PBL curriculum. In Neufeld and Barrows (1974), it is referred to as a philosophy.

PBL originally emerged as a tutorial supplementing a traditional neuroscience course in the first year of a traditional curriculum (Barrows & Tamblyn, 1976). It gradually evolved into a pre-clinical curriculum alternative to the conventional first years of basic science coursework in medical education (for a complete and detailed description of the program, and particularly the admission policy, see Hamilton, 1976 and Ferrier et al., 1978). It is worth mentioning that the 'PBL' we discuss here is a PBL as a curriculum and not as a method.

Although novel in some respects PBL, rests in general on ideas that originated much earlier and had been nurtured by many researchers (Dewey, 1944; Bruner, 1961; 1971; Rogers, 1969; Ausubel et al., 1978; Knowles, 1985). Some of these ideas indeed go back to antiquity. Comenius (1592-1670) in 'The Great Didactic' stated that *"Let the main objective be as follows: to seek and find a method of instruction - by which*

teachers may teach less but learners may learn more" (cited in Spoulding, 1969). Dewey criticized the ways in which science had been taught as early as at the beginning of the 20th century. Indeed, the novelty lies in tying these often disparate traditions together within one perspective.

Barrows and Tamblyn, (1980) defined PBL as a pre-clinical curriculum, student-centred, small group tutorials, with a problem solving-format as the major educational method. In the following, we try to give an account of the theoretical basis as well as the different concepts embodied in this program.

To start with, it was mentioned before that the main educational approach in PBL program is problem solving. This method is expected to yield a twofold potential benefit; 1) learning occurs in the exploration of the problem and 2) it develops skills in dealing with problems. The former is the main creed of inquiry learning theory and the latter is the substrate of process education.

The chief concern of the former is the learning process and how it should be carried out to achieve a truly meaningful learning. It claims that learners learn and generate abstract concepts best when, in unstructured learning situations, they are encouraged to actively seek out and experience concrete consequences of any given principle. The theory is based on the observations of learners exposed to principles in science and mathematics.

Among advocates of discovery/inquiry theory Bruner (1961) and Ausubel et al. (1987) were some of the more visible. They argued that desirable learning in any field could take place only through the student's experience of discovery, and not by way of a passive student attending a teacher's exposition. Discovery learning yielded to a spectrum of more precise 'inquiry' approaches to instruction in part due to the fact that the theory was difficult to operationalize clearly.

Process education, on the other hand, deals with the content of learning. Bruner (1961, 1971), Rogers (1969), Ausubel, et al. (1987) and many others argued for process education. They questioned the adequacy of imparting inert knowledge to the students' mind. Such knowledge, they believed, rapidly becomes obsolete due to the ever-accelerating amount of information and social changes. They tried to encourage the educational system to emphasize the acquisition of more enduring skills such as 'lifelong learning' and 'problem-solving-skills', instead of the transmission of factual knowledge.

Interest in process education, in turn, inspired researchers interested in the study of cognitive processes underlying these skills, i.e. problem-solving skills. Also in medicine, scientists spent considerable effort trying to describe how a physician, when confronted with a patient, collected data and arrive at a diagnosis. These efforts led researchers to identify patterns of information processing that were assumed to be commonly employed by physicians during clinical problem-solving activities, namely, the hypothetico-deductive model of diagnostic reasoning. According to this model,

early in the doctor-patient encounter, doctors introduce a number of hypotheses pertaining to the etiology of the patients' complaints. Through history-taking and physical examination, information is then gathered and evaluated in order to prove or disprove these hypotheses (see Elstein et al., 1978 and Balla, 1989).

This kind of reasoning is considered to be backward or top-down reasoning, that is, a hypothesized conclusion derives the acquisition and interpretation of supportive information. According to this method of analysis initial cues activate hypotheses about the conclusion. These hypotheses in turn suggest additional cues and inspire a subsequent search of the information for verification.

Forward or bottom-up reasoning, on the other hand, describes a method of analysis in which the initial assimilation of data leads directly to the conclusion. Put differently, the former reasoning is characterized as a means-ends analysis whereas the latter is a schema-driven process (Gilhooly, 1990, cited in Albanese & Mitchell, 1993). I do not intend to discuss the advantages and disadvantages of the two methods of reasoning mentioned above. However, I cannot refrain from observing that the forward or bottom-up method of reasoning is more likely to be used by experts whereas the backward or top-down reasoning is typical of novices according to the studies tried to investigate the cognitive process of medical problem solving:

> Gilhooly (1990), in reviewing the literature on expert-novice differences, develops several maxims drawn from this knowledge. One of this maxims is that experts engage in forward reasoning. Novices, on the other hand, engage in backward reasoning- working backwards from the unknowns to the givens. Gilhooly cites several studies and states 'working backwards is not only typical of novice but also retards the development of skill, by focusing the subject's attention on goal- starting state differences. This reduce the likelihood of learning those connections between problem-givens and correct actions which experts exploit' (Gilhooly 1990, p. 263). What this means is that the emphasis on training in backward reasoning in PBL may interfere with developing forward reasoning skills. The results from Claesson and Bohuizen (1985) and Patel et al. (1991) are consistent with this concern. Patel et al. (1991) caution that in the context of self-directed learning more attention needs to be given to correcting erroneous reasoning (Albanese & Mitchell, 1993, pp. 59-60).

In order to see how inquiry learning, process education and the hypothetico-deductive model of medical problem solving tied together in the hands of the founders of PBL, a description of the learning process in a typical PBL tutorial group will be provided.

As the name 'PBL' implies, central to this program is that learning starts with problems (carefully chosen unstructured), either paper or real patient cases simulating real life clinical situations. The content of the problems are of a varying nature and could deal with biomedical, behavioural, and

psychological sciences depending upon the goal of the term (Ways et al., 1973).

According to the founders of PBL, this program would bring about both vertical and horizontal curricular integration. The former, as was discussed in chapter 1, means integrating pre clinical and clinical parts of the medical education (through application of basic and behavioural science concepts to clinical cases). The aim is to increase students' motivation to learn basic science courses by illustrating the relevance of basic science to clinical medicine, and promote students' retention of basic science knowledge. The latter brings about interdisciplinary basic science integration.

Two things should be pointed out here; firstly these kinds of integration have already been implemented at the Case University School of Medicine. Secondly, the 'Case Method' as an instructional approach was used at Harvard Business School where the students were given detailed written cases to be analyzed by applying concepts learned in the course of their education (see McNair, 1954).

Learning is stimulated basically through a small group of students being supervised by a tutor who facilitates the learning process (Barrows, 1983, 1988, Neams & Powis; 1981) but Barrows et al. (1986) proposed a method of introducing PBL programs into larger groups.

Learning starts, as was mentioned above, with introducing patient's problem(s) to the students. A typical problem would have the following pattern, i.e., a fifty-two year old woman complains of chest pain, ... The task of the members of the group is to discuss the problem and provide tentative explanations of the phenomena at hand, in terms of underpinning mechanisms.

To do so, different hypotheses regarding the causes of the patient's complaint(s) would be put forward and discussed by the students. The student group would then prove or disprove the hypotheses in the light of the information and evidence collected by direct questioning of the simulated patient. To do this, the students would critically examine the evidences, defend their points of view and plans of action to gain further information if necessary, identify and define their personal learning needs, devise a plan of self-directed study to acquire information to help to achieve a resolution or understanding of the problem(s) under scrutiny.

It was mentioned previously that the role of the tutor is to facilitate the learning process, not to provide specific content information. Typically, he/she might require students to summarize the discussion, elaborate their thoughts, identify areas of uncertainty, etc. The intention here is firstly to activate and sustain students' interest in learning. The second aim is to trigger and foster diagnostic reasoning or the physician's problem-solving skills.

In summary, what was said above showed that 'student-centred' activities embody the components of inquiry learning. The emphasis on acquisition of general skills (problem-solving skills) that can be applied to collect,

interpret, and integrate data from any clinical case is the substrate of the process education and the method of instruction is inspired by the hypothetico-deductive model of diagnostic reasoning (Barrows, 1985). Putting all these together, the originators of PBL had hoped, this program would contribute to: cultivating and fostering generalizable clinical problem-solving skills; the acquisition of relevant and usable basic science knowledge which is retained better and applied more easily in the clinical years; increase motivation to learn; and promote self-directed learning skills (to a limited extent of course) more effectively than traditional systems of medical education (Barrows, 1986, 1990).

The founders of PBL claim that this program was developed in accordance with the accepted principles of learning and would promote more meaningful learning among the students. Learning in this perspective would mean comprehension of the basic concepts and the principles behind them and integration of the new information into an existing cognitive framework, rather than merely the addition of new information to the existing memory without conceptual integration. According to them, traditional curricula dominated by lectures promoted passive rote learning and inhibited clinical problem-solving skills (Barrows & Bennett, 1972; Barrows & Mitchell, 1975).

In order for meaningful learning to occur, the researchers argue, several prerequisites should be provided (Anderson, 1977; Anderson, 1990). That is, the knowledge should be presented in the context that approximates the context in which this knowledge is to be applied (Shoemaker, 1960; Tulving & Thomson, 1973; Godden & Baddeley, 1975; Brown et al., 1989); the teaching should be built upon student's existing knowledge (Ausubel et al., 1978); activation of the previous knowledge (Anderson & Biddle, 1975; Anderson & Reder, 1979; Mayer, 1975, 1982) and integration of the new information into the existing cognitive framework (Bartlett, 1932; Ausubel et al., 1978). It is proposed that PBL programs provide students with the prerequisites mentioned above; that is, the reception of information or the point of departure in learning is a real context, it builds upon the students' existing knowledge, activates previous knowledge, encourages active learning as well as allowing for application of learned information to practical clinical problems which approximates the future job situation (Walton & Matthews, 1989). The latter constitutes in turn an extensive feedback to the learners.

But as we have seen in the literature, the definition of PBL varied from what was described above. Due to the flexibility, sometimes some other characteristics have been added to the definition of PBL depending upon the contextual circumstances in general (Harden et al., 1984).

The coexistence of PBL and community-orientation in a medical education program may lead to confusion with regard to the origin of the program. It has already been pointed out (see chapter 1), that PBL coincided with the emergence of the community-oriented program (Fulop, 1984; Kaufman, 1985). PBL is a program adaptable to different contents and

many settings (Boud & Feletti, 1991). Community-orientation, on the other hand, is a curricular design aiming at educating community-oriented physicians. Although the two innovations differ from each other with respect to their origin and purpose, they merged and were most often presented as being synonymous. Though the merging of the two methods has sometimes impeded the dissemination of PBL, this nevertheless, contributed to its dissemination, particularly in many of the developing countries.

In 1984, the Association of American Medical Colleges published a report by the project panel on the general professional education of physicians and college preparation for medicine named "Physicians for the Twenty-First Century". This report concentrated on themes such as purposes, problems, priorities, prospects, strategies, resources, admission policies, linkages between basic and postgraduate education, and integration with health care. The problems and obstacles defined are: rote memorization of a vast amount of factual details, lack of identification of essential concepts and principles as well as interdisciplinary communication and independent learning, to mention only a few instances. Some essential recommendations given in this report, counted as vital to the development of medical education, are very much those embodied in the PBL. According to Recommendations (3), 'Medical faculties should examine critically the number of lecture hours they now schedule and consider major reductions in this passive form of learning' and Recommendation (4) states that 'Medical faculties should offer educational experiences that require students to be active, independent learners and problem solvers, rather than passive recipients of information' (Muller, 1984, p. 12).

Gaining endorsement from different influential organizations fuelled the further dissemination of PBL so that today this innovative method is implemented in many medical schools as well as other lines of education around the world (Boud & Feletti, 1991).

To keep pace with the international development of medical education, the National Board of Universities and Colleges proposed major changes in medical education in Sweden in 1982 (En Förnyad Läkarutbildning, UHÄ rapport, 1982, pp. 127-128). This program focused on similar, if not identical themes, as being important for the development of medical education. Inspired by these ideas, the Linköping Faculty of Health Sciences implemented a PBL program. An extensive description of this program is provided in chapter six.

Self-directed learning

The concept 'self-directed learning' is frequently discussed when talking about PBL curricula and sometimes these discussions unintentionally lead to misunderstandings. It may be assumed that students in the PBL programs are entirely free to pursuit their learning activities in every respect. It

was therefore considered necessary to define and clarify the term self-directed learning and what it means for the quality of learning.

As was mentioned before, the PBL program was developed to bring about a shift in emphasis. It focuses on the acquisition of appropriate attitudes and values, as well as medical knowledge.

One of the expectations was that PBL would be able to cultivate a distinctive ability of being self-directed in learning among the students. Self-directed learning includes step-wise activities or processes such as: perception of one's learning needs, a desire to rectify the identified deficiencies in one's knowledge or skill, self-reliance, an ability to translate learning needs into realistic learning objectives, an ability to identify, evaluate and make effective use of resources relevant to one's learning objectives, an ability to assess one's subsequent achievement relative to the original learning goals. In Knowles (1975) own words:

> In its broadest meaning, 'self-directed learning' describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes (ibid. p. 18).

In an attempt to clarify the concept 'self-directed learning', Svensson (1989) distinguished between two aspects of learning, cognitive activities and the factors external to these activities. As far as the former is concerned, he states, learners are self-directed in learning because of the very nature of the learning activity:

> Learning is fundamentally self-directed, i.e., learning is dependent on the student's own activity in relation to a situation, a given material or content. The learning depends on what is paid attention to, in what way and students differ in this. In previous studies, we have described some of these differences as differences in approaches to the content (deep and surface approach, holistic and atomistic approach). These aspects and differences in self-directedness concern cognitive activities related to learning (ibid. p. 6).

As far as the external factors and their relations to the cognitive activities are concerned, educational programs can vary in the degree to which they provide the students with this experience :

> These aspects of the activities are influenced in different ways by factors external to cognitive approach and to the content treated. These factors are of two kinds, general orientations and attitudes of the students and factors external to the student. The factors external to doing the task may influence it in two ways, by setting or defining the task and by influencing the way of carrying out the task. These influences may be separated in the sense that someone else may set a general task and leave you free to decide how to do it, but also, you may be free to decide on a task but someone else may tell you how to do it. So we may have self-directedness in at least these two different sense.

> Both forms of self-directedness may exist to a varying extent within organized education. However self-directedness within organized education is always within certain limits set by the teachers and/or educational planners (ibid. p. 6).

PBL programs provide students with the opportunity of being free to engage in learning insofar as the external factors are concerned and, of course, one should not forget that PBL curriculum is an organized education program and as such has its framework set by educational planners. Proponents of PBL believe that self-directed learning skills should and can be developed. They believe that PBL curricula enhances self-directed learning skills which, in turn, would increase the probability and quality of learning. The role of examination in promoting self-directed learning, and influencing students' other learning behaviour, for that matter, is not a new fact. The inconsistency between the explicit, established standards of a given program and its evaluation system would jeopardize the measurement of the learning outcome. Using examination methods permitting diversity and versatility in learning, i.e. Triple Jump examination, is of crucial importance in that it preserves, to a large extent, the consistency of the philosophy and evaluation. Triple Jump (T.J.) examination is based on a prepared case protocol, which the student discusses on an individual basis with the examiner. In the first step, the student is given a health care problem (case) and his or her ability to generate a hypothesis is observed. In the second step, which is a 3-hour-long, the student identifies issues of major importance and studies them in more detail. In step 3, the student provides the examiner with a written description of how the study time was used. The results are then evaluated and the student is given feedback (Painvin et al., 1979). The difficulties involving in creating examinations consonant with the PBL philosophy are discussed by Feletti, (1980).

Advocates of self-directed learning through PBL stress the importance of learning to identify, access and use a variety of information sources effectively.

One might reasonably say that no one has yet documented the fact that medical graduates indeed lack self-directed learning skills. This is perfectly true. But it is also true that, in retrospect, 75% of McMaster graduates identify their medical experience of self-directed learning as a particular strength of the curriculum (Woodward, 1990).

The findings of the present study also showed that in their interview, the students from both the pre-clinical and clinical part of medical education at Linköping University emphasized the importance of self-directed learning in their education.

Such appreciation is an important endorsement of the independent learning behaviour encouraged in PBL. However, whether or not the students take advantage of the large variety of available learning materials while studying, in order to use the time efficiently, is open to question.

Chapter 3

STUDENT LEARNING IN HIGHER EDUCATION: A RECONCEPTUALIZATION OF LEARNING

Qualitative research into the effects of higher education

The impact of higher education as an educational context has been the focus of several investigations during the last sixty years. Different aspects of this impact have been studied particularly as far as the attitudes, values, political orientation and the function of examination are concerned (Feldman & Newcomb, 1969) or they focused on educational achievement (Pace, 1969). In an attempt to map the effects of higher education, Dahlgren (1984) pointed out that these effects are differential. With respect to the growth of factual knowledge, he argues, formal education has a profound effect in a short-term perspective. These effects, he says, are less impressive in a more long-term perspective. He furthermore indicated that higher education has a minor effect on the conceptual development of the students in different academic disciplines.

Although to some extent differing in research methodology, the investigations to be presented here are relevant to the present study as far as both the focus and theoretical perspectives are concerned. Another criterion for selecting these studies is that they all recognize the fundamental importance of taking into account the actor's view as starting points namely, the students' views.

The assessment system and its effects on the totality of students' social and academic life, is the focus of a famous study by Becker et al. (1968). 'Making the Grade', was a participant observation study which went on for three years. The authors discovered what they called a 'perspective of grade point average', among the students. This 'perspective' not only affected the whole experience that students had at college, but also served as a framework through which the students made sense of the college experience. The students perceived that their success in college was measured by 'the grade point average'. Consequently, students' principal occupation to a varying degree became that of actively chasing grades.

While in the former study it was shown how students' perception of the organizational pressure makes them act in certain ways in order to cope with the perceived educational requirements, Perry (1970) discovered that the learning obstacles the new college students encountered sprang from their view of knowledge. His empirical study showed the impact of higher education on the intellectual and ethical maturity of the students. By means

of a longitudinal open-ended interview he obtained a rich data base which enabled him to describe a scheme of development which runs through nine developmental phases. He showed how students moved during their university education from having an dualistic perspective of knowledge to a view where knowledge is perceived as being relative and the truth remains provisional, needing personal interpretation and commitment. One important point Perry expressed is the fact that students need a lot of support from their teachers in order to safely pass through the different developmental stages. If the students do not receive the necessary help and confidence, Perry argues, they may not only delay their progress but also regress to earlier phases.

Next is another study which showed how different the lecturers' perceptions of student learning could be from that of the students'. Snyder (1971), in his influential study 'The Hidden Curriculum', pointed to the effect of educational context in the form of an unstated but practised curriculum on the way in which students perceived the assessment system. Snyder showed that parallel with the formal curriculum, there was an informal (hidden) curriculum which students had to take into account. This was brought about as a result of the discrepancy in many circumstances where the theory espoused by teachers did not correspond with its practice. For example, teachers said to the students that what was required in their course was that they should read widely and think about the broad issues involved in those subjects, but the assessment system consisted of frequent multiple choice tests which required rote learning of facts. The formal stated curriculum was in this case actually jeopardized by the hidden curriculum which, as a result of the assessment system, required students to spend a great deal of their time on rote learning of facts.

Miller and Parlett (1974), in their illuminative study, concentrated on how students dealt with their examination requirements. The researchers used semi-structure interviews, questionnaires as well as participant observation as the instruments for gathering data. The result brought out a distinction between the students on the level of awareness as regards the examination system. The authors argued that there was a difference between those students who appeared to be conscious of cues (cue-conscious) about the examinations given by the staff, those who appeared to actively seek these hints about the examinations (cue-seeking), and those who were not conscious of such cues (cue-deaf). It seemed to the authors that the two former groups of students had actually perceived an aspect of the hidden curriculum which the latter group of students were ignorant of. Cue-conscious and cue-seeking students also appeared to have been more successful in the final examination than the cue-deaf students.

These investigations illustrate that the context of learning, i.e. the frame-work of both the campus and the formal and hidden curriculum, not only has a bearing on the opportunities that the students can see are offered to them but can also act as a guideline for how students understand the university world. In other words, students' perceptions of the different contex-

tual components of learning affect the ways they go about their learning activities.

While the studies presented in this section were more directed toward the impact of educational context on students' social and academic life, the phenomenographic investigations which will be presented in the next section, were originally developed to examine the content of what was being studied in higher education.

In the following, some of the investigations which have been carried out within phenomenographic field of research and have a relevance to the present study will be described.

Phenomenographic research into learning in higher education and its contribution to meaningful learning or learning as conceptual change

The history of learning is as long as the existence of human beings. Historically, the first time that learning and its outcome was scientifically dealt with was by Ebbinghaus in his famous investigation of memory by using nonsense syllables (Bower & Hilgard, 1981). The kind of learning then focused on was purely quantitative, and memory was thought of as a passive receiver of information. The major focus was on the amount of learning materials that could be reproduced after a certain amount of practice, and the amount of knowledge retained after a certain period of time. The quantitative perspective on knowledge, has been and is applied in the study of learning activities, be it the educational system or wherever the learning outcome was to be measured, for that matter. The predominant perspective in research into learning for a long time remained quantitative.

Bartlett (1932), for the first time indicated that memory does reconstruct what one reads, and what one learns is one's personal interpretation of the learning material, not a reproduction of it. This was the first step towards looking differently at learning. From then on many investigations were carried out to establish a solid foundation for the fact that learning is not just, and should not be considered as, a compilation of isolated facts which can then be measured in terms of the degree of resemblance between the stimulus and the reproduction of it by the learner.

Among the researchers who, during the first half of the present century, attempted to further the knowledge about meaningful learning and promoted the expansion of the new view of learning Katona (1945) has a special position. With the help of experiments, he was able to distinguish between two kinds of learning processes; learning by memorizing and learning by organizing. In this way, he not only showed how different ways (skills) of dealing with materials led to different outcomes but also

laid the earliest foundation of what was later to be known as the learning to learn phenomenon.

During the second half of the 20th century, many researchers with different theoretical backgrounds tried to investigate learning. Interest in meaningful learning has increased in the psychological and educational research community and it has joined with another innovative view, the explicit orientation of educational psychologists of the time (Bruner, 1961, 1971; Rogers, 1969) to form a new perspective of knowledge.

With his interest in concept development, Ausubel is one of the most visible spokesmen among those who contributed to the research on meaningful learning. He stated that learning occurs when the newly presented information is related or linked to the previously learned knowledge. Furthermore, he indicated that learning is a matter of constructing meaning and argued that individuals interpret new information in the light of their previous knowledge and experiences. Abstract concepts, he said, are therefore formed from a set of experiences which consists of two shades of meaning, one which is unique to each individual (his/her previous basis of knowledge and personal experiences) and the other which is shared with others (new learning situation - be it information presented by teachers in formal educational context or other everyday informal learning situations). He also argued in favour of inquiry approaches to instruction (Ausubel et al., 1978).

In the early 1970s, a series of investigations began in Sweden and has since influenced researchers all over the world. The focus of these studies is mainly on learning in higher education and they have investigated learning in situations that either resemble or are the real everyday situations in which students learn.

The research approach was that of *phenomenography* which was originally developed to meaningfully investigate learning from texts and what university students learned from them. Extensive descriptions of findings of these studies have been reported previously (Marton et al., 1984; Ramsden, 1988). In later works, however, this research methodology has been applied to investigate broader concepts (Dahlgren, 1989; Hasselgren, 1981; Fallsberg, 1991).

These works broke the dominant tradition in research into learning in several important ways. They not only opened a new perspective on knowledge and learning in general but also showed how learning in educational institutions, particularly higher education, is carried out.

This view rests on a primacy of a certain sort of learning which emphasizes the fact that the essence of meaningful learning in general requires a level of description that takes the content of the outcome of learning into account. This means that if significant aspects of individual differences in learning are to be understood, the answer to the question of *what* has been learned is of profound importance.

Furthermore, according to this perspective, learning in higher education could and should be focused on changing students' conceptions of aspects of the world around them. The way in which students think about any particular subject content is fundamental in education. The significance of understanding of the concepts in different fields of education is emphasized, be it medical, technological or humanistic. In order to cultivate such learning among the students, teachers should take into account what students know already (before learning), during learning and after learning. Put differently, this perspective brings about a *reconceptualization of learning*.

Students' approach to learning

In this section, an account is given of the definition and historical background of the concept *approach to learning* which the reader will frequently encounter in the present thesis. Approach to learning has its origin in the early works by a Swedish research group (Marton et al., 1977; Svensson, 1976; Dahlgren 1975; Säljö, 1982). Subsequently, researchers from other countries contributed to furthering the knowledge on this issue. The section on student approach thus deals, in turn, with how this concept came into being and was later developed and its implications for medical education. Following this introduction, some of the studies carried out in the phenomenographic field of research into the impact of higher education will be discussed.

As was mentioned previously, a series of investigations related to the human learning process was carried out by Marton and his colleagues. These studies emphasized the crucial impact of both 'intention' (Marton & Säljö, 1976a, 1976b, 1984) and organizing principles (Svensson, 1976, 1977) on the outcomes of learning and finally showed the importance of analyzing those outcomes in terms of the specific content of the learning task. The research method required that student learning be described in terms of its content and everyday learning tasks as experienced by the student. The intention of these studies was to relate the quality of what students learned to the approach they adopted. Here, it must be noted that the term approach, according to Marton, includes intention (what the learner is looking out for) and process (how that intention is realized).

The research findings (Marton & Säljö, 1984) identified differences in the intentions of students as they approached the task and in the processes they used as they were trying to learn from a text. The approaches that were used by the students during the experiment were categorized by the authors as a *deep approach* or a *surface approach*.

A deep approach was used when students set out with the intention of actively seeking out the author's main idea or meaning. In order to reach the ultimate understanding, the students examined the evidence in relation

to the conclusions and also related the new ideas embodied in the text to their previous knowledge and personal experience. In contrast, the surface approach involved attention to only the surface structure of the language, defining the learning task and the memorization of facts contained in the text. In doing so, they failed to appreciate some of the principles and structures contained in the text. By these means, Marton and his colleagues showed empirically how students' approaches to learning are affected by their intentions - *Students who did not get 'the point' failed to do so simply because they were not looking for it* (p. 39). So, according to Marton, it is the intention to learn the text itself which makes people misunderstand it.

At about the same time, Svensson (1976) applied an alternative form of analysis to the same set of data to explain the differences in outcome. He concentrated first on students' accounts of what they remembered and from the characteristics of these outcomes, he drew conclusions about the nature of the processes that accounted for what was remembered. He concluded that the main variation in cognitive approach was between *holistic* and *atomistic*. In the former approach, during reading, students' concentration was directed toward understanding the text as a whole. They searched for the author's intention, relating the content to a larger context and delimiting the main parts of the text. In the atomistic approach students focused on specific comparisons in the text, on the sequence of the text, but not the main parts, and memorizing details. Unlike the holistic approach, there was a lack of an orientation toward the message as a whole.

In this respect, Biggs (1979) in Australia and Entwistle and Ramsden (1983) in Britain independently investigated the approach of students to their studying. Biggs identified three dimensions of the study process which he called *utilizing*, *internalizing*, and *achieving*. The equivalent studies conducted by Entwistle and his colleagues also identified three main patterns which they called *reproducing orientation*, *meaning orientation*, and *achieving* or *strategic orientation*. The result of both studies indicated a motivational and a strategic component contributing to each approach. It is necessary to mention that the utilizing/reproducing orientation is equivalent to the concept 'surface approach' and the internalizing/meaning orientation is equivalent to a 'deep approach' identified by Marton and Säljö (1976a). What Biggs (1979) and Enwistle and Ramsden (1983) meant by achieving or strategic orientation needs to be explained further. Students with an achieving orientation used a strategic approach: their main intention was to be successful; they study what is required in the examinations; they are motivated by a sense of competition with other students and an ambition to achieve higher marks. Therefore, at any one time they might choose to use a deep or a surface approach depending on what they feel would produce the most desirable results.

However, it can be seen that each approach is characterized by features relating to the students' motivation and intention towards the subject being studied.

Surface learners are predominantly motivated by a concern to complete the course or by a fear of failure. Their intention is to fulfil assessment requirements by the reproduction of factual knowledge. The process used by them to reach this goal is rote learning and the outcome is a superficial level of understanding.

Students with a strategic approach seemed to adopt processes which, at any point in time, may be similar to the surface and the deep approach. These groups of students are motivated by the need to achieve high grades and compete with other students. Their intention, thus, is to be successful by whatever means necessary.

Deep learners are motivated by an interest in the subject matter and/or by its vocational relevance. They intend to search for concepts within the learning materials and understand their meaning and inter-relationships. It is interesting to note that the process applied in order to carry out this intention, according to Pask (1986) varies between what he called *operation learning* and *comprehension learning*. One way to achieve understanding, as stated by Pask, is operation learning, which involves a logical step-by-step approach and a cautious acceptance of generalizations only when based on sound evidence. Another way is comprehension learning, which involves the use of analogies to relate ideas to real life and an emphasis on the broad outline of ideas and their interconnections. Pask concluded that the most effective learners are those who are able to use operation or comprehension learning where appropriate. Pask called this group *versatile learners*. The inappropriate reliance on one or the other of these two processes has been called a learning *pathology*. The need to use versatility by university students is appreciated by Pask.

To summarize, students have a tendency to adopt one of the three distinct approaches to learning: a deep meaning-oriented approach, where the student sets out to understand the meaning of what is to be learned; a surface reproducing-oriented approach, where the student sets out to memorize as much information as possible of the learning task; a strategic approach, where the student, depending on the assessment requirements, chooses either a deep or a surface approach.

Learning approach and outcome

The relationship between the students' approach and the subsequent level of understanding has been shown by Marton and Säljö (1976b) and Svensson (1977). These reports indicate that the quality of what the students learned was related to the approach they adopted in that those students who adopted a deep approach to learning not only had a more complete understanding but were also able to remember more factual details, both immediately afterwards and after a certain amount of time. The reports also confirmed that students who consistently adopted a deep ap-

proach were more successful in passing examinations than those who consistently adopted a surface approach.

Implications for medical education

At the beginning of this section, it was mentioned that students have a preferred learning style but that they will adapt their way of learning to their conception of what is required of them. Contextual components appear to affect study approach. The approaches applied by students when tackling the learning task have a crucial impact on their academic success and, more important, on the quality of learning they acquire.

Based on the evidence, it seems reasonable that by obtaining adequate knowledge of student approach, those involved in educational programs in general and medical education in particular should be able to adopt an educational approach that could create supporting factors for fostering and enhancing a deep study approach which, in turn, may produce the desirable learning outcome expected from university students. Or, as Newble and Entwistle, (1986) suggested, by recognizing students' approach it is not only possible to help the students to develop an appropriate learning approach but also to reform the whole basis of educational approach in medical schools.

Empirical studies on the impact of higher education

In the previous section, the early work of the Swedish research group on the learning approach as well as some of the contributions made by other researchers were discussed. As was mentioned previously, phenomenography was originally developed to investigate learning from texts but also dealt with studying broader concepts. The studies to be discussed here are examples of the application of this methodology to investigate the impact of higher education.

Dahlgren (1978) studied the learning outcomes of students after having studied an introductory course in economics. He investigated university students' conceptions of 'price'. In order to do this he asked the students a very simple question: 'Why does a bun cost about one (Swedish) crown?' Using a phenomenographic approach in his analysis of the data, he came to understand that students have either of the two following conceptions of price, A) The price is dependent on the relationship between the supply of and demand for buns; and B) The price is equal to the value of the bun. He then concluded that there was little evidence of qualitative changes in the students' conceptions of the basic economic concepts after having completed a course on the topic mentioned above.

Säljö (1982) investigated the outcome of learning in different groups of people with different educational backgrounds. One of the main results of

this study is that people's conceptions of what is held to be knowledge in the educational context appeared to determine how people approach the given learning task and what the learning outcome will be.

As was mentioned before learning from texts has not been the only focus of the phenomenographic studies. There are several investigations which involved other aspects of the impact of higher education. Also other settings than higher education have been the subject of these studies.

The effects of formal education on students is the focus of the following two investigations.

Hasselgren (1981), in a longitudinal study, has investigated the effects of formal education on the structural level of the subjects' conceptions. He compared a group of pre-school student-teachers (experiment group) with a group of physiotherapy students (control group). He asked them to describe what they saw in video-taped sequences of children at play. The sessions were repeated three times; at the start of a course, in the middle of the second term, and at the beginning of the third and final term. The results showed a development in four stages through which students moved from a fragmentary to an abstracting description. His analysis shows a substantial difference in the patterns of regression, stability and development between the students in the experimental and the control group. The author concluded that the formal educational experiences undergone by the experimental group had an impact on their way of understanding a phenomenon (children at play) that is central to pre-school teachers.

The impact of education on the students' conceptions of economic phenomena is the focus of an investigation by Dahlgren (1989). He interviewed, among others, a group of students of business administration and a group of medical students about their conceptions of the most crucial contemporary economic problems and the cause of famine in the underdeveloped countries at the beginning and the end of their education. The results showed a change from having a political, distribution-oriented perspective on the two questions mentioned above to a more depoliticized efficiency perspective. This change has not been found among the medical students.

The findings of these investigations are important in several respects. They broke the dominant tradition in research on learning. They not only provided a qualitative methodology which allowed students' experiences of learning to be studied more systematically but, more important, challenged the predominant conception of learning as the addition of unrelated knowledge. Another contribution was the realization of the importance of the intention and organizing principles in the quality of the learning outcome and analyzing those outcomes of learning in terms of the specific content of the learning task. Last but not the least, they emphasized the fact that student learning should be described in terms of realistic content and everyday tasks as experienced by students; it should be approached from the student's perspective not from that of researchers.

Chapter 4

A REVIEW OF THE COMPARATIVE RESEARCH: PBL AND CONVENTIONAL CURRICULA

The purpose of this study, as was noted in chapter one, is to examine students' experience of medical education, approaches to learning and comprehension of a scientific text. It is not my intention to review the evidence of the overall benefits or deficiencies of PBL. Consequently, I will refrain from commenting on the entire studies comparing different educational outcomes of PBL programs with those from the traditional program. Instead, I will present evidence derived from studies aimed at comparing the issues mentioned above. In this review, my intention is both to present advantages and disadvantages of PBL with regard to the issues presented above and comment on the methodological aspects of this research.

Students' experience of the curriculum

The effect of the educational context on the students is not a new phenomenon. It has existed ever since any learning activity was carried out. It has, however, been more intensively concentrated on by contemporary psychological and educational researchers due to the fact that its crucial impact on the students' behaviour is being increasingly recognized, particularly from the 1950s and onwards.

Educational context can mean different things. What we mean by educational context here is the content of curriculum and its underlying philosophy as well as its effects on students' emotional well-being and motivation to learn (a review of some of these studies is presented in chapter three).

One of the basic convictions of the phenomenographic research on learning, as indicated previously, is the realization that a) every teacher should base his/her teaching on the actual thinking of the students as regards the subject area he/she is going to teach, and b) the importance of contextual impact of education on how they learn and what they learn.

One of the initial and central concerns of PBL is to bring about an enjoyable and motivating educational environment in which learning is more stimulating and students are motivated to learn. It is not the intention of the present study to deal with the motivation issue. What we are concerned about here is to see how students feel about the overall content of their curriculum and the environment they study in. In what follows, some of the studies, which have compared students from PBL with students exposed to

a traditional curriculum with regard to their experience of the educational context, will be presented.

As was mentioned earlier, the University of New Mexico runs two separate but parallel programs; a PBL and a traditional program. Baca et al., (1990) attempted in a study to see how students at this university perceived their learning environment. More specifically, the focus of this investigation was on students' attitudes toward medical education, levels of confidence, self-esteem, and perceived stress.

The results of her study showed that students from the PBL program felt that they had a more meaningful and flexible curriculum which not only encouraged student interaction but also provided a better emotional climate than did the conventional program.

In another study, Post and Drop (1990), studied students' perceptions of the strengths and weaknesses of the content of a PBL program as compared with those of students with a conventional curriculum. The aim of their study was to examine the perceptions of graduates of different medical schools with respect to the amount of emphasis placed on various subjects in the medical curricula. They administered a 45-item questionnaire to all medical graduates of the University of Limburg from 1982 through 1986 and to the 1983 graduates of all other medical schools in the Netherlands. The Limburg University has a PBL program whereas the other curricula are conventional. The students were required to indicate the amount of attention given to particular subjects on a 5-point scale ranging from 'too much' to 'too little'.

The results showed that primary care, mental health, multidisciplinary co-operation, human behaviour, social skill, preparation for postgraduate education, and ethical issues, according to the students, were given more time in the PBL curriculum as compared with the traditional curricula. Hospital-based medicine and biomedical science, on the other hand, were among the subjects which received more attention in the traditional programs.

Woodward (1990), also tried to survey the McMaster University students' perceptions of their education shortly before MD graduation. She wanted to obtain information about not only how students experienced medical education, but also their future plans. She gave students a list of 23 features (features pertinent to different aspects of education, i.e. from work in tutorial group to features relating to the admission policy, etc.). The students were required to select from the list up to four features which they thought to be the program's strengths and up to four features which they considered to be program's weaknesses.

The findings showed that four features had been given priority by the students over the years. These are problem-based learning, work in tutorial groups, self-directed learning and the opportunity for independent study. The author pointed out that recently the elective program had been added

to the features mentioned above. The evaluation system and clinical-skill teaching are considered to be the weaknesses of the program.

The impact of educational context on approach to learning

The way in which students approach their learning was dealt with in the preceding chapter. In this section, the relationship between learning approach and educational context as well as a review of studies attempting to compare PBL students' learning approaches with those of students from traditional medical schools will be described.

The effect of the educational context on the student's approach to learning has been demonstrated by several researchers (Ramsden & Entwistle, 1981; Entwistle & Ramsden, 1983). The influence of the teaching characteristics (teaching style), i.e. the degree of enthusiasm and commitment of the teachers and the structure, pace and the level at which the knowledge is presented to the students, on the learning approach has been shown by Ramsden (1984). He furthermore suggested that students' approaches to learning can be fostered by creating a context which facilitates the development of a meaning-orientation approach which seems to be closely allied to the intellectual processes:

> It is worth re-emphasising that our concern here is with the ways in which students' *perceptions* of assessment, teaching, and courses may influence their attitudes and approaches to studying, and not with apparently objective characteristics of the context such as continuos assessment methods, the use of learning packages and aids, and the division of teaching methods into lectures, tutorials and other techniques. We can best try to understand the effect of the context of learning by examining the relationship between the effects of the context of learning by examining relationship between students' approaches and their perceptions of learning tasks at a number of separate but interconnected levels. Student's approaches depend on their interest in the task and their previous experience of the area to which it relates; these influences are themselves associated with the degree of choice over content and method of learning available to the student. The perceived demands and support of teachers, and the content of the subject, also influence the students' approaches. At the most general level, the atmosphere of the academic department affects students' study orientations and ultimately their approaches to specific academic task (ibid. p. 147).

In order to illustrate the relationship between educational context and approach to learning, Coles (1985), in his longitudinal comparative studie, has investigated students' learning style through the use of self-report inventories (Entwistle, 1981) both on entry and then again at the end of their first year of study. He compared the learning approaches of students from two medical schools: one with a conventional curriculum and the other applying problem-based learning. He indicated that students from conven-

tional schools showed a shift towards poorer study approaches; more reproducing, less meaning and versatility, whereas students at the problem-based school maintained their entry approaches to studying. The investigator concluded that observed differences in approaches are due to differences in the educational climate.

In this respect, deVolder and deGrave (1989) administered a 30-item self-report questionnaire (Ramsden & Entwistle, 1981), to the students on the first day of the academic year and after having completed a six week introductory course in PBL training. The conclusion drawn by the authors regarding this study is:

> Our study indicates that these approaches are made desirable by the training in PBL given during the introductory period. ... since we were able to show that even in a relatively short period of time during which intensive training takes place, approaches to learning can be changed (ibid. p. 264).

Newble and Clarke (1986) compared the approaches adopted by medical students in their first, second and final years at the University of Adelaide (traditional) and the University of Newcastle (PBL) in Australia by utilizing the Lancaster Approaches to Studying Inventory (LI). The Inventory is a 64-item self-report questionnaire developed by Entwistle and Ramsden (1983). The findings showed substantial differences; the problem- based school being higher on deep approach and lower on surface approach than the traditional school, in all those years. The observed differences in the students' approaches to learning, the researchers stated, might be due to the educational environment. Furthermore, they concluded that the problem-based learning approach may have caused these differences.

The effect of examination on the way students approach their studies is also shown by Newble and Gordon (1985) and Newble and Clarke (1986) where they surveyed students from a traditional medical school at two different times, first before an MCQ examination and then before a clinical skills examination. The findings indicated that students first showed an inclination towards superficial approaches and then towards comprehension approaches. The impact of examination on learning is also shown by Newble and Jaeger (1983).

Research on academic achievements

Among the studies which compare the learning outcome of PBL with that of a traditional program, which by the way are very few, no single one employed the assessment tools consistent with the kind of learning PBL expected to encourage among the students.

The following is a description of some of these studies mainly performed in the medical schools belonging to The Network of Community-Oriented Educational Institutions for Health Sciences.

Baca et al., (1990) compared the performances of different groups of medical students from the University of New Mexico in National Board of Medical Examiners (NBME) examinations. The New Mexico medical faculty houses both a traditional and a PBL curriculum by way of parallel tracks. According to the authors, the students in the PBL program tended to score slightly lower on the NBME Part I examination (which covers basic sciences and is given at the end of the second year) than students in the conventional program. But the students' scores on the NBME Part II examination (which covers the clinical sciences and is given during the fourth year) were similar.

Another attempt was made in Australia by Saunders et al. (1990) where they compared learning outcomes of a PBL curriculum- the University of Newcastle - with that of a traditional one - the University of Sydney. 243 participants formed the control group whereas the experimental group consisted of 45 students.

The authors gave an 80-item multiple-choice test to final-year medical students at the respective universities. The questions mainly dealt with internal medicine. The results indicated that students from the University of Sydney, answered 71 percent of the questions correctly whereas the corresponding percentage for the Newcastle students was 67 per cent.

In an attempt to compare academic achievement in different schools, Verwijnen et al. (1990) in the Netherlands employed what is called a progress test as a measuring instrument. This achievement test consists of about 250 true-false items covering different medical areas. In this study, the academic achievements of the students at the Limburg medical school with a PBL program were compared with those of the three other medical students in a conventional program. Four groups of students were compared in this study; a) the experimental group contained the whole school population of 565 students. The control groups were: b) 550 volunteers, from the second school; c) 703 volunteer students from a third school and, finally, a fourth group of students; d)167 participants randomly selected by the researchers from a fourth school.

The results showed that at certain times there were differences among the four schools with regard to their learning outcomes. For example, in one of the medical schools with a conventional curriculum, students made less progress than those in the other schools in their second year and more progress in their fourth year. These differences, the authors argue, tended to be small and non-systematic. The Limburg students scored somewhat lower than students from two of the other schools at three measuring points, but by the sixth year these differences had disappeared.

Some concluding remarks on chapters 2-4

Problem-based learning, as was mentioned in chapter 2, was developed in response to the pressures emanating from the lack of consistency between the needs of society and the goals of medical education. These pressures were compounded by the existing deficiencies in the structure, content and instructional system of medical education (see chapter 1).

As we saw in chapter 1, there were several responses to the need for the advancement of medical education. Among those who responded to the call for promotion of medical education, the founders of PBL had high profile. They argue that this curriculum is educationally very powerful, i.e. it cultivates self-directed learning, learning to learn, and problem-solving skills, etc., among the students. The students educated with this curriculum will, they say, experience a proper educational setting in which they are encouraged to become active participants in the learning process. It promotes meaningful learning among the students. This kind of learning not only yields a better retention of knowledge over an extended period of time but also brings about more success in the academic work.

In chapter 3, a body of work investigating the effects of higher education on student's learning was presented. The studies discussed in chapter 3 conveyed three important messages. 1) They presented new approaches in studying the impact of higher education on students' learning. 2) They illustrate the importance of the educational context to student's learning as well as the quality of the learning outcome. 3) They introduced a different perspective on knowledge and learning.

Chapter 4, attempted to review investigations about whether PBL is fulfilling its promises. The studies focused on three objectives; students' experience of the educational environment, students' approach to learning, and students' learning outcome.

The results of the studies on students' experience of the curriculum showed that PBL students are more content with the educational context they study in compared with their traditional counterparts.

The available data on students' approach to learning indicated that PBL programs contributed to the promotion of a deep-approach among the students in contrast to the traditional program which provoked highly strategic learning behaviour among the students. They also showed the power of examinations in influencing student's approach to learning.

As regards the level of academic achievement, the studies reviewed in chapter 4, on the whole, demonstrated no significant differences between PBL and traditional programs.

Given that there are many practical impediments in the design of the comparative studies, the fact remains that traditional methods of evaluation are inconsistent with the nature of the issues under scrutiny. The present study is, therefore, an attempt to examine the issues mentioned above by applying alternative methods with an emphasis on qualitative analysis.

Chapter 5

THE RESEARCH PERSPECTIVE

A qualitative approach to studying the impact of higher education

> If I had to reduce all of educational psychology to just one principle, I would say this: the most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly (Ausubel et al., 1978).

The research approach used in the present thesis is 'phenomenography', a kind of approach in which intensive interviews with the participants are systematically carried out and analyzed. This kind of research approach offers a different way of looking at the phenomena of learning and, for that matter, other existing phenomena in our surrounding world. It has been developed and applied in several investigations into student learning in higher education since 1970 (Marton, 1981). To our knowledge, the approach has, however, never before been applied in comparisons between educational programs.

Over many years the nature and purpose of social science inquiries, of which educational research is a part, have been subject to a serious widespread debate in the scientific community. Central to this discussion was determining whether the social science problems should be investigated in the same way as natural phenomena are in the sciences, or that the subject of social science is of differing nature, and as such should be investigated accordingly.

Among many scientists who tried to give a more clear and reasonably sound argument in resolving this problem are Smith (1989) and Marton (1981).

Showing a clear inclination towards the application of the qualitative methods in social and educational inquiry, Smith (1989) characterized these methods in two ways. One of these, he says, has to do with the practical procedures or 'how-to-do-it questions' and the other involves the justification given in support of practice or, as he termed it, 'the logic of justification'.

He then continues the discussion and argues that this debate over different methods of investigation and preferring one to the other is fundamentally about 'the logic of justification' associated with the different perspectives. He maintains that, too often, it was not the logic of justification but rather the technical aspects of the two methods that came to the fore in the debates. Ultimately, one almost forgets about the basic epistemological and ontological questions such as 'what is the nature of social reality?; 'what is the relationship of the investigator to that which is investigated?; 'how is

truth to be defined or characterized?' and so on. In other words, it is the nature of man which comes first not how we should study it. According to him, each approach can occasionally 'borrow' the specific, individual techniques conventionally thought to be associated with the other approach. One thing we should never forget is being consistent within one perspective and the logic of justification underlying it.

A similar line of reasoning about the nature of the methodological obstacles is presented by Marton (1981) where he argues that the world can be seen from two different perspectives. From what he termed the first-order perspective the world is seen as it is, and from the second-order perspective the world is described as conceived. In other words, each perspective provides us with a different aspect of the world. He then argues in favour of the second-order perspective stating that 'aspects of reality described at this level cannot be derived from aspects of reality derived at another level.'

However, Marton took a further step in this respect. Based on these justifications, and inspired by the work of Piaget (1952) and Werthimer (1945) he developed and offered a research approach that came to be known as phenomenography. This is the research approach which is applied in the present thesis since it seemed to be congruent with the kind of issues this study attempts to illuminate. In other words, if one wants to see which conceptions students have of a particular phenomenon, how they approach their learning tasks, what their conceptions of the educational context are, how they experience their university education, or other second-order questions, for that matter, one has to seek the answers within the students' own opinions regarding these issues.

The Phenomenographic field of research

It was mentioned previously that Marton's analysis (1981) enabled him to establish phenomenography - 'descriptions of conceptions' - as an independent field of research.

Phenomenography, by definition, is to unfold the content of consciousness by means of description. The purpose of research is to understand the world as conceived how things are seen or experienced rather than the world as defined or observed by the researcher.

The nature of phenomenography is thus the combination of a qualitative perspective and an application of this perspective to the study of how the world is conceived. There are other forms of qualitative analysis. They differ mainly with regard to the extent of interpretation permitted or exercised.

Central to qualitative approaches to research is to obtain an understanding of the nature, or kind, of a phenomenon in question. Following the same aim, phenomenography, which is a particular type of the qualitative methods, is based furthermore on convictions that people do hold a limited

number of conceptions as regards phenomena in the surrounding world. These conceptions can be characterized in the form of distinct categories. These categories then describe how these conceptions are qualitatively constructed in different ways (Larsson, 1986). Categories which illustrate distinctions between people's conceptions of the phenomena in the world around them, thus, are the result of the phenomenographic investigations.

To establish different categories of conceptions, the researcher follows a systematic procedure. In the process through which the researcher obtains the categories of conceptions, the empirical data is the main and only basis on which he/she works. What this means is that the starting point for the work of analysis is the empirical data which are obtained through tape-recorded interviews which are subsequently transcribed. The investigator does not have an a priori theory according to which the data should be classified (Dahlgren & Fallsberg, 1991). In other words, as was shown above, phenomenography deals with describing, characterizing and analyzing the meaning that people ascribe to different phenomena in the surrounding world, be it the 'text' they deal with in the educational settings or the concepts they encounter in everyday life situations.

Contextual analysis

Since learning, approaches to learning and educational context may mean different things to each student, they are rather difficult research problems to deal with. They consist of relations between different components, and every component is unique to each student. Contextual analysis was considered as a methodological possibility, when trying to investigate and clarify the findings and studying the relations between some instances in the categorizations.

Contextual analysis, emerged from attempts to observe and describe knowledge and study skill (Svensson, 1976). This research approach has its roots in the phenomenographic field of research. Applying phenomenography to the issue of the impact of education involves carrying out qualitative analyses of the students' conceptions of central phenomena in the educational program at various points of time: and, of course, at least at the end of the education.

Contextual analysis as a research methodology is characterized by its simultaneous regard for both the analytical and the contextual aspects. In other words, in the contextual analysis the researcher goes one step further than just describing the categories of conceptions. He or she should, according to the author, try to capture and describe the nature of the relations between conceptions about the context in which they are moulded:

> The results, in research of the kind argued for, are both categorizations and relations between categorizations in the form of combinations or pattern of categories. What is given as a starting point for the analysis is the relational concept delimited, aspects observed and

> specific data in those aspects. A contextual analysis, then, must not only mean an aggregation of specific data with generally given interpretations, but a delimitation of specific data related to each other as aspects of the same phenomena (Svensson 1985, p. 6).

Contextual analysis, as can be seen in the excerpt above, thus attempts to examine the relationships between categories of conceptions. Conceptions can be studied in combination with other conceptions or with other types of conceptions. Results of the analysis are thus both the categories of conceptions and combinations or patterns of combinations between different categories.

In contextual analysis, the individual and the situational contexts are the points of departure. According to this methodology, the meaning of specific data is dependent on the context. Svensson (1985) stated that learning is a context-dependent phenomenon and as such has to be understood contextually in terms of the content of relations to the surrounding world and that these relations are internal:

> ..., that the distinction between internal and external relations is the most fundamental distinction to be made and it is central to the definition of contextual analysis. Contextual analysis means the construction of internal relations (ibid. p. 9).

External relations, according to the author, refer to the relations when factors external to a system cause changes within that system, i.e. the impact of the weather on an aeroplane. Internal relations, on the other hand, are when properties of a system are determined by the relations between components within a system, i.e. there is a compatibility between the process of learning and its outcome.

According to the author, the general characteristics of this approach consist of delimiting wholes and parts. The approach is analytic in the sense that it differentiates and abstracts whole qualities (comprising parts and relations between parts), it is comparative in emphasizing differences and similarities, it is descriptive and emphasizes meaning as the fundamental concern and categories as the form of describing and generalizing meaning. Gerrevall (1992) and Bendz (1995) are where examples is utilized contextual analysis.

In an attempt to describe the nature of the contextual analysis, Svensson (1985) compared it with the other two dominating research approaches; the positivistic and the hermeneutic.

Table 1. A modification of Svensson's (1985, pp 11 and 13) comparison of research approaches complemented with phenomenography

	Positivistic	Hermeneutic/ phenomenological	Contextual analysis	Phenomenography
Method	1. Definition of categories (variables)	1. Observational Delimitation of the whole data material or phenomenon	1. Delimitation of wholes (phenomena)	1. Delimitation of wholes (phenomena)
	2. Observation of the existence of instances of the categories (measurement)	2. Supplementing and/or reducing transformations of data (interpretation/ intuition)	2. Differentiation of whole qualities representing the nature of the phenomena	2. Differentiation of whole qualities representing the nature of the phenomena
Results meaning	1. Frequencies of instances in categories and combinations of categories and their interpretation	1. Descriptions (and groupings) of cases	1. Description of similarities and differences in meaning of whole qualities in the form of categories and relations between categories.	1. Description of similarities and differences in meaning of whole qualities in the form of categories and relations between categories.
	2. Degree of statistical generality of categories and combinations	2. Relevance of description within a theoretical/ methodological frame	2. Generality in the form of decontextualization and analogies	

Contextual analysis, Svensson states, should not be considered as a combination of certain parts of the positivistic and hermeneutic/ phenomenological approaches to research. It is a different approach and represents a different relation between methods and results, which also means that the main parts of the method and the results are different compared to corresponding parts of the two research approaches presented above.

Chapter 6

THE EDUCATIONAL CONTEXT

A description of the educational context is necessary in order to provide a background and a frame of reference for a contextual analysis and permit the analysis of the any differences between the two programs, regarding the issues the present study tries to examine.

Before furthering our knowledge about the educational contexts under discussion, some description of the objectives of medical education in Sweden, outlined by the National Board of Universities and Colleges, will be provided. The rest of this chapter will deal in turn with descriptions of the curriculum implemented at the Linköping Faculty of Health Sciences and at the Faculty of Medicine at Gothenburg University as well as an appraisal of the two programs.

The need for a renewal of medical education

In order to participate in and contribute to the international attempts at improving medical education, the Swedish National Board of Universities and Colleges proposed major changes in medical education in 1982. The emphasis of the program are very much in line with that considered to be important to the advancement of medical education by the international medical education community.

The goals of the central educational plan are that the graduates of medical schools should have acquired or developed the knowledge, abilities, and attitudes necessary, together with internship, to qualify to practice medicine. The objectives of the program emphasize the need to educate physicians who will not only be effective in contributing to the provision of health care and to the solution of the wide range of the health problems, but also will be adaptable to changing needs in health and medical service. The general goals have been stated as follows:

- that the student acquires knowledge and skills which constitute the basis of the medical profession, as well as of continuous training, and which together with general practice within the in-service medical training - are required to become a certified physician; and
- that the student acquires knowledge and skills which prepare him/her for research and development work within the field of medicine and health;
- that the student acquires abilities in critical analysis and evaluation as well as creativity and flexibility;
- that the student acquires a comprehensive picture of the human being, based on an understanding of the relations between the individual's

state of health and human-biological, social and other background conditions;

- that the student - to be able to work preventively - acquires knowledge about those conditions in society that have an impact on human health;
- that the student develops self-awareness and empathy;
- that the student acquires the kind of knowledge about the economy and organisation of medical care that is of importance to all physicians, and develops a professional mode of functioning which prepares for team-work and co-operation with all groups of personnel;
- that the student acquires the kind of understanding of other countries and cultures and of international conditions that is important for his/her future professional work (En Förnyad Läkarutbildning, UHÄ rapport, 1982, pp. 127-128).

Linköping University acted in accordance with the spirit of this document by developing a program comprising changes pertaining to the competence profile as well as pedagogy, i.e. the desire to implement a PBL program. Betänkande av Linköpingsutredningen om Integrerade Vårdutbildningar (1981).

The Linköping Faculty of Health Sciences

As was noted above, the Linköping University responded to the international and national calls for the reformation of medical education by taking several measures. Adoption of PBL program was part of these efforts (Bergdahl et al., 1991).

The ideas of the reform, however, emerged, in the early 1970s through the work of Areskog (1981). This program is in effect from the autumn term of 1986, when the Faculty admitted its first students. Total enrolment is 60-70 students yearly.

Linköping University has around 13,000 students in different programs of education comprising the health care professions, engineering, business administration, teacher education and liberal arts. There is also a department of interdisciplinary research and postgraduate studies.

It was noted in chapter 2 that variations of PBL have been implemented at different medical schools throughout the world. A PBL model applied at the Faculty of Health Sciences in Linköping, is called Student-centred, Problem-based, Integrated, Community-based, Elective, and Systematic (SPICES), which is a modification of the Maastricht model. For a more comprehensive description, see Rahimi (1991).

The General objectives

The curriculum implemented was decided upon by the Faculty Educational and Research Board.

The program has objectives, structure and learning methods that require the students to be self-directed in learning and emphasizing problem-solving as a method of learning.

This means that students are required to develop the ability to identify medical problems and define them in terms of basic mechanisms and to be able to choose and use various sources of information (books, scientific journal articles, etc.) appropriately to solve them. To do this he/she should therefore be able to identify his/her learning needs, evaluate critically sources of information, evaluate his/her learning in relation to his/her needs (Bergdahl et al., 1989, 1990a, 1990b; Kjellgren et al., 1993).

The educational methods used have been chosen to train the student in the skills described above. The student has the main responsibility for attaining the competence set and has considerable freedom in choosing between various learning resources.

The main educational approach, as was mentioned above, is problem-based learning. Paper cases or real patients are used to focus on problems in human biology, clinical medicine, community medicine and behavioural science in a context which students will meet in their future work. (Ludvigsson et al., 1985; Bergdahl et al., 1990a, 1990b; Carlsson & Haglund, 1987).

The students work with these problems in small groups with a tutor. The small groups (Base Group) each consist of six to seven students (heterogeneous as to sex, age, as well as previous experience in the medical fields). Students do not usually remain in the same group throughout a whole term but rather about 5-10 weeks (in order to acquire the ability to work with different people), except for terms six and seven (in order to facilitate and develop students' long-term educational planning ability).

The initiative for learning is to a large extent in the hands of students (although not entirely for the obvious reason of the framework set by the educational planners.

Staff from theoretical and clinical disciplines share the tutorship throughout the whole program in which they try to stimulate active learning among the students. This kind of problem-based learning is similar to research and clinical problem solving.

The tutorial group sessions, clerkships in primary care, hospitals and emergency service are compulsory, as are some skill-training sessions. Resources such as lectures and questioning sessions are voluntary. The general objectives of the program are:

- emphasis on scientific thinking, in-depth studies and electives
- co-ordination of human biology and clinical medicine throughout the program
- integration of traditional subjects based on problems in clinical medicine and human biology
- emphasis on prevention and health promotion
- behavioural science in relevant contexts and systematic training in interpersonal skills
- involvement in medical service with few students per tutor and rotation; the whole county of Östergötland constitutes the base for clerkships in hospitals and in primary care
- frequent integration with other health programs at the Faculty of Health Sciences and training in team-work
- examinations based on objectives and evaluating competency concerning knowledge, skills and attitudes in an integrated way.

Selection process

During the period when I collected the data, the same selection process was applied for gaining admission to any medical school in Sweden.

According to the process all applicants were required to submit their application forms to the Swedish National Board of Universities and Colleges (UHÄ). The criteria for selection were the overall grade point average of all completed secondary education, work experience, and the grade point average from the national college entrance examination, each of which was given a specific weighting.

General Structure of the PBL program

Three phases - Health, Health-Disease, and Clinic

The curriculum for medical students in Linköping consists of 220 credit points. For the information of those not familiar with the Swedish system of education, one point corresponds to one week's full-time studies. An academic year is 40 weeks and a term is 20 weeks.

The program lasts for 5 1/2 years and is divided into three phases of unequal length; terms 1-3, terms 4-5 and terms 6-11. Each phase consists of a course and within the phases each term is a unit, where several subjects are integrated.

During the first two phases, the context of studies is the organ systems. In this context, also changes during the life cycle and subjects such as ethics, patient-doctor relationship, medical technology, etc. are dealt with. These so-called *streaks* (Svedin & Kock, 1990) continue during phase III,

where the main context is the various clinical clerkships. The focus of phase III is on various parts of clinical medicine.

Examinations take place after each term and phase. On satisfactory completion of each phase of the program plus the final examination which comprises the content of the three phases and is given after examination of phase three, an MD degree is awarded. The graduates are not allowed to practice medicine unless they have finished their internship program.

Evaluation occurs in the form of written, oral and practical tests. Written tests items are mainly essay questions. The grading is pass or fail. An overview of the curriculum is given in appendix I.

Phase I, terms 1-3

Cell, man and society (Human Biology- Skin and Locomotion, Human Biology- Metabolism and Blood, Human Biology- Reproduction, Homeostasis and Environment Adaptation) (60 credit points).

In phase I (the first half of the term 1), the medical students together with students from all the other program at the Faculty of Health Sciences are introduced to Problem-based learning; self-directed learning and working in small tutorial groups. The interaction between people of various ages and between man and society are studied.

During the rest of the phase, the studies of the body are organized in the context of organ systems. Emphasis is upon normal functions and basic human biological mechanisms. Furthermore, the reactions of the body to disturbed function and environmental factors are included.

Clinical contact in primary care takes place to a limited extent and deals especially with interpersonal skills training. Physical examination with an emphasis on normal functions is practised in relation to the studies of various organ systems. During this phase, first aid in connection with resuscitation and accidents is practised.

Community medicine, prevention and ethics are dealt with in connection with patient cases and are also co-ordinated with the other health education programs in separate themes.

The objectives are related to the general aims and require the student to be able to:

- analyze the normal structure and function of the human body and its changes during the life cycle
- explain the mechanisms of compensation for principally disturbed function in an organ system and the reaction pattern of the body due to stress from environmental factors
- perform and document a physical examination with emphasis on normal findings
- show understanding for one's own and other people's reactions at interviews and physical examinations

- use problem-based learning and critical appraisal of resources of information
- show understanding for relations between people's life conditions and their health
- identify possibilities for preservation of health
- describe the organization of medical service, social service and care and the connections between them
- discuss health problems in various cultures and countries.

Phase II, terms 4-5

Health and Disease -Skin and Locomotion, Nervous System, Circulation and Respiration. Health and Disease- Nutrition, Digestion, Metabolism and Hormonal Regulation, Blood, Renal and Reproductive Systems (40 credit points).

During this phase, the organ systems are studied with the emphasis on basic pathophysiological mechanisms, pathology, symptoms and signs of diseases and extensions in human biology. Furthermore, diagnostic methods, principles of various forms of therapy, prevention and health promotion are dealt with.

Training in interpersonal skills is continued from phase I and developed further. Clinical contact is broadened. Laboratory diagnostic procedures and physical examination are practised with emphasis on pathological findings. Furthermore, the student must carry out a limited in-depth study. Phase II also contains an elective period of 3 weeks. Integration with the other health education programs continues.

According to the phase's general objectives the student should be able to:

- explain symptoms and causes of diseases related to disturbed structure and function
- analyze the mechanisms and the body for preservation of health
- perform and document a physical examination with emphasis on deviation from normal
- communicate with patients and staff and write a patient record
- test a diagnosis by using a diagnostic method and be able to perform simple tests
- describe principles of therapy
- search and sum up scientific information
- recognize connections between ill health and vital conditions and be able to suggest measures
- make suggestions for preventive steps against diseases

- analyze the organization and economy of health care in a county and relate this to other functions of society
- explain health care problems in other cultures and countries
- show understanding for the variation in disease symptoms in relation to language and cultural background.

Phase III, terms 6-11

Clinical Medicine, Community Medicine and Human Biology (120 credit points).

This phase places the main emphasis on various parts of clinical medicine. Knowledge and skills from the previous phases are deepened and extended. Human biology and basic mechanisms continue and occupy about 20% of the time. Clerkships in hospitals and in primary care taken place in rotations of relatively long duration where a holistic view of the patients is emphasized. Community and preventive medicine reappear in the clinical context and, in addition, from the final part of the program. There is a three-week clerkship in primary care each term. The last term contains a 10-week elective period during which the student can choose any subject with an obvious relevance to the program. This period may be located abroad. The students, assumed to have competence in problem-based learning and independent work, study both alone and in groups at the end of the phase. Consequently, the role of the tutor changes gradually.

Integration with other health education students at the Faculty continues during the clinical clerkship as team-work around patients or special themes. Multiprofessional teamwork in community medicine is also offered during the final term.

The emphasis in this phase is placed on the acquisition of the following objectives; the student should be able to:

- evaluate symptoms and be able to take decisions about initial steps
- analyze clinical problems from the point of view of human biological mechanisms
- analyze and document findings from physical examinations
- employ therapeutic an attitude and a holistic view when meeting patients
- evaluate and choose diagnostic methods to test a diagnosis
- evaluate various forms of therapy and be able to use therapy for common diseases and in emergency situations
- independently use problem-based learning and apply a critical appraisal to scientific information as a base for an ongoing development of competence

- evaluate relations between ill health and vital conditions and be able to take measures independently and in co-operation with other providers of care and public authorities
- carry out preventive steps for individuals and suggest such steps for groups
- suggest measures for the development of care and its co-operation with other public institutions
- evaluate economical consequences of medical decisions in relation to both the individual patient and to society
- evaluate health care problems in various cultures and countries.

Gothenburg University

Gothenburg, the second largest city in Sweden is located on the west coast of the country. Gothenburg University was established in 1887 and today, has five faculties; Medicine, Odontology, Social Sciences, Humanities, and Mathematics and Natural Sciences with about 22.000 students. The Faculty of Medicine was founded in 1949, and has a traditional discipline-based curriculum.

An overview of the curriculum implemented at the Gothenburg Faculty of Medicine is provided in appendix 2.

General structure of the curriculum

Two stages - Preclinic and Clinic

Medical education at Gothenburg university is divided into two parts; the preclinical and the clinical. The preclinical education consists of five terms (1-5) and the clinical part comprises six terms (6-11).

Since the educational plan implemented at the Faculty of Medicine is a typical Flexnerian curriculum, I will only describe some examples of the different features of both pre clinical and clinical stages.

The focus of the program is basically on medical knowledge and acquiring additional knowledge, skills and attitudes, i.e., critical thinking, interpersonal relationships, etc., there is almost no emphasis on at the preclinical stage. Contacts with patients, interpersonal relationships, etc., are brought up for the first time in term six and mainly positioned at the clinical stage (term 6, 8 and 10) where the students will acquire some knowledge in this respect.

The main method of instruction at the Faculty of Medicine is the lecture format, particularly during preclinical stage of education. Teaching in groups, workshops, and seminars is generally speaking, used occasionally throughout the education program. But it is mainly used during the clinical part of the education. The system of assessment is basically in the form of

written tests. The test items are primarily in the form of the multiple-choice questions. The essay questions are occasionally combined with this, particularly during clinical studies. Written examinations combined with oral and practical item tests are given particularly during the clinical stage.

The curriculum implemented at the Faculty of Medicine and decided on the Educational and Research Board of the Faculty is as follows:

Preclinical stage terms 1-5

This stage consists of five terms and starts with courses such as Basic Medical and Physiological Chemistry, Cell Biology and concludes with courses in Pathology, Genetics, and Pharmacology and lasts for 2 1/2 years.

The first term of medical education starts with a one-week introduction course. It is followed by basic medical and physiological chemistry which lasts 7,5 weeks. The course covers topics such as safety instructions and laboratory techniques, general chemistry, proteins and physical chemistry, enzymes and carbohydrates and, finally, the chemical aspects of cell structure (membranes).

The last part of the first term of medical education consists of a cell biology course. It covers a 10,5 week long introduction to molecular biology, cell biology, and molecular genetics.

According to the course objectives in term 1, medical students should acquire basic knowledge about the biochemical processes, their effects especially on the human body and their importance in medicine. They should also acquire the ability to critically evaluate the new knowledge that is a prerequisite to the understanding of knowledge about the process of methods.

Term 2 includes two courses; Anatomy and Histology. The anatomy course runs over 14 weeks and includes an introduction and general anatomy, the trunck, thoracic and abdominal visceral organs, the urogenital system, head and neck and a dissection course.

In the histology course, description of morphology and structure/function relationships of cells, tissues and organs of the human body are focused on. Cell morphology is described at the light microscopic and ultra structural levels. The duration of the course is 7 weeks.

Pathology and pharmacology courses form the last part of the preclinical stage.

The former course comprises topics such as general pathology, cellular pathology, inflammatory diseases, tumours and circulation disorders as well as organ pathology. Students also receive training in performing autopsies, light microscopy, individual studies, and gross-specimen examination during this course.

During the pharmacology course, students acquire knowledge of the effects of drugs and toxins which is essential for medical training. Modes of action and the effects upon organs and organ systems, pharmacodynamics

and drug absorption, distribution, biotransformation and excretion- pharmacokinetic are dealt with as well.

Clinical stage terms 6-11

Clinical education starts after completion of the preclinical period and lasts for 3 years. Term 6 includes courses such as Medical Psychology, Medical Examination Methods, Clinical Physiology, Clinical Chemistry, General Internal Medicine and Infectious Medicine.

As was noted above, term 6 starts with Medical Psychology, during which students acquire knowledge about the patient-doctor relationship, communication skills and psychological understanding, body functions related to emotional strain, as well as practical psychology and theoretical orientation in psychology. The method of instruction during this course comprises three weeks of lectures, work-shops and seminars as well as field work with an essay and oral presentation.

One of the courses students study during term 7 is general internal medicine. The term contains lectures, demonstrations and group education in internal medicine with clinical work in the wards.

Term 8 consists of one course in surgery which includes topics such as rotations in general surgery, urological surgery, orthopedic surgery, neurosurgery, plastic-surgery; thoracic and cardiac and cardio-vascular surgery and anaesthesiology are included. The overall aim is to give a base for knowledge of the most common surgical diseases, their diagnosis and treatment and management of patients with traumas. This course deals with principles for diagnosis, work-up and treatment of diseases of the visceral organs, the musculo-skeletal system and trauma, with particular emphasis on diseases for which surgical treatment can be applicable. A completed course in surgery will provide the necessary basis for internship.

Term 10 consists of courses in Radiology, War and Catastrophe Medicine, Ophthalmology, Oto-Rhino-Laryngology, Neurology, Primary Health Care.

As was said above, Primary Health Care is one of the courses dealt with in term 10. The course consists of three weeks of education in primary health care and deals with the concept of primary health care. Students also acquire knowledge about working at the primary health care centres, preventive medicine as well as co-operation with other groups working within the health care system. This is done by working at both the health care centres in Gothenburg as well as centres located in the western part of Sweden for a period of one week at respective locations.

Term 11 comprises courses such as Neonathology, Pediatrics, Obstetrics and Gynecology, and Child and Adolescent Psychiatry which lasts for 20 weeks.

An appraisal of the two programs

A review of the two educational programs at LiU and GU presented above, showed that, first of all, the specific aims of the general medical education at LiU are that the student should acquire fundamental medical knowledge, at the same time as acquiring additional knowledge and skills in the psychological and sociological areas essential to a comprehensive medicine is considered to be equally important.

The importance of interpersonal relationships and the social and cultural aspects of medical care should be considered not as separate entities but as components of the philosophy and practice of medicine. In addition, the student should develop and maintain appropriate attitudes concerning the PBL program, i.e. self-directed learning. The acquisition of knowledge other than medical knowledge, i.e., interpersonal relationships, attitudes and skills, etc., is given more attention and time at the early stage of the program than at the clinical stage where studying diseases is more heavily emphasized.

As we have seen, most of the principles of medical education at LiU are established and concentrated in phase I, assumed to lay a good foundation for the subsequent phases. The objectives of the clinical studies, as is evident from the description of the written curriculum, are consistent with the philosophy of the PBL program.

Unlike the program implemented at LiU, according to the educational program at GU, the specific aims of the general medical program are mainly that the student should acquire as much fundamental medical knowledge as possible in the theoretical disciplines essential to medical education, while the emphasis on acquiring any additional knowledge, skills, or attitudes in most of the terms is almost non-existent (see Läkarlinjen in Göteborg 1991/1992). This is particularly true during the preclinical part of the education program. Only in term 1 are students explicitly required to acquire the ability to make a critical appraisal of scientific knowledge (ibid. p. 32). The first time the issue of the doctor-patient relationship is brought up in the curriculum is in term 6 (ibid. p. 48). The doctor-patient relationship, scientific thinking as well as a somewhat holistic view of patients are encouraged among the students during the clinical phase of the education program where these issues are occasionally emphasized (ibid. p. 57, p. 66).

A review of the curricula reveals that clinical clerkships in both programs, however, are organized and carried out in a setting traditionally composed of individual specialities. This implies that the setting in which clinical education is carried out is similar in both PBL and traditional medical schools. It should be noticed here that context is also defined as the context as experienced.

Whether or not this fact creates any problems for the attenuation of the effects of PBL remains to be seen.

Overviews of the curricula implemented at the Linköping's Faculty of Health Sciences and the Faculty of Medicine at Gothenburg University are provided in appendices I an II. These are the curricula that were applied in the academic year 1991/1992, when this research was conducted.

Chapter 7

METHOD AND RESEARCH PROCEDURE

This chapter attempts to give a presentation of the design of the present study, the selection of participants and the data collection method. This chapter, furthermore, includes a description of how the qualitative analysis of the data was carried out.

Design

The empirical section of this study consists of interviews with 60 medical students from a conventional and a PBL-program.

This study, as the title implies, is a comparative investigation. It is a qualitative analysis of the impact of PBL on students' conceptions of the educational context, learning approach in general as well as their ways of approaching a specific task and the learning outcome thereof, as compared with those of students in a traditional curriculum. One reasonable alternative way of investigating these problems could have been a longitudinal design which, for obvious reasons of time and costs, seemed difficult to carry out.

The principal characteristics of the present study are as follows: interview as the method of data collection; phenomenography and contextual analysis as the research approach and the method of analysis; and descriptive and comparative reporting of the results.

Choosing these characteristics seemed appropriate due firstly to the kind of philosophy guiding the study and secondly to the nature of the problems under scrutiny.

Subjects

In this study, a comparison is made between experiences among students in a PBL and a conventional program, approaches to learning as well as understanding of the learning material. The attempt therefore is to make the inter-intra-group comparison with respect to the problems that constitute the main concerns of the present study. To examine the above-mentioned objectives the following steps have been taken.

Two groups of thirty students which were equally distributed over two levels of the education program; preclinical and clinical, from a problem-based curriculum - Linköping university - as well as a conventional discipline-based curriculum - Gothenburg university - were compared. The selection criterion for this comparison is that the students from each respec-

tive group are at the same level in their studies (in the present case, both groups are at the end of the preclinical and clinical stages).

The rationale behind selecting these two levels of education is that the conventional undergraduate curriculum in medical education is believed to present students with vast amounts of largely abstract information to be learned in preparation for the clinical years, where it must then be applied, has been shown by many educational researchers to be largely unproductive and highly problematic (see chapter 1). Typically, students experience overload, lose their motivation, find it difficult to see the relevance of what they have been taught, and later on experience difficulties in retrieving and applying the knowledge they learned early on in a clinical setting.

PBL, on the other hand, as mentioned in chapter 2, is originally a preclinical curriculum which is based on widely accepted educational principles. These principles of education are established from the very start of the education program. It was hoped that the subsequent levels of education would benefit from them.

Data Collection

Permission to carry out the data collection was obtained from the boards of medical education at the respective universities. The interviews were conducted in October and November, 1992. Necessary information about the study was given to the students during a meeting before contacting the subjects who were selected to participate in the interview. The participants were randomly selected from the lists of students names which were obtained from the registers of the two universities for this purpose.

The participants were contacted by telephone when a time for the interview was agreed upon. It should also be added that the participants were paid for their participation.

The interviews were held at the respective universities and include the following phases;

Phase 1. The reading of an article which served as learning material.
Phase 2. An interview session where the participants had to
a) answer a set of questions on the content of the article;
b) answer a number of questions on how they set about reading and learning in this particular situation;
c) answer a number of questions concerning the participants' normal methods and habits of study;
d) answer a number of questions concerning the participants' experience of their study days at the university.

At the beginning of each session, the subjects were told that they were going to read a 24-page medical article and that they would have to answer some questions about it afterwards. Since the aim was to find out how stu-

dents understand and deal with the learning materials and how they experienced their university education, our primary effort was to make sure that the reading task and the situation were as close to the reality as possible. No time limit was imposed on the participants during the reading of the article. It should be mentioned here that the article was taken away from the students before they answered the content-oriented questions.

Each session was run individually with each participant. All communication during phase 2, was tape-recorded. The tapes were later transcribed verbatim. The transcripts of the students' answers to the questions asked during the interview sessions made up the data base. All the interviews were made by the author and the average length of the interviews was one and a half hours.

Principles evolved for selecting the learning task

In order to be consistent with the perspective guiding the study, i.e. that a description of students' understanding of a learning task should be permitted, the selection of the article was carefully considered. To achieve this, first of all I tried to choose learning material which was very much of the kind the students usually encounter in their everyday study situations. The content should have both clinical and theoretical aspects, and the subject as well as the content are dealt with at both universities.

I chose several well-known medical journals which are available in all the medical schools' libraries and culled several articles from them. Then, together with some of the experts both in educational as well as medical fields, I reviewed them and selected the article in question which was considered to be a proper learning task for both the five termers and ten termers in several respects. The subject of physiology is one of tne basic disciplines and students are expected to be familiar with it. The topic was also considered to be something tangible for all the students. The content of the article is of interest to the students at both levels of education and is dealt with at the both universities.

A summary of the article to be read

The article is 24 pages long (of which 14 pages are pictures and references). It is a review article presented at the meeting of the Physiological Society held in Oxford on 27 July, 1990 at the Society's Annual Review Lecture by Olga Hudlicka. The article is about the growth of blood vessels in skeletal as well as cardiac muscles and the factors that could possibly be involved in this phenomenon. The article is divided into nine different sections. Sections two to six cover the discussion pertaining factors involved in increased capillarization in skeletal muscles whereas section seven to nine deal with the effort of explaining the role of different factors in induc-

ing growth of capillaries in heart muscle. The article starts with a very brief description of the basic pattern of the growth of vessels.

Section two deals with the growth of capillaries under physiological conditions, indicating that proliferation of capillaries is very rare in adult organisms and also gives a description of different ways of demonstrating capillary proliferation in different tissues. The focal point of the next section is the growth of capillaries in chronically stimulated skeletal muscles, and concludes that capillary proliferation in chronically stimulated muscles differs in human and other animals such as cats. The fourth section is about the possible involvement of metabolic factors in capillarization in stimulated muscles pointing to the unlikeliness of the effect of either hypoxia or growth factors in initiating capillary growth. Section five attempts to find out the possible role played by blood flow in the growth of capillaries, something which seems to have an essential role in capillarization. The possible role played by mechanical factors, is the main intention in section six.

The author convincingly shows the involvement of mechanical factors in capillary growth in skeletal muscle. After giving a short description of the growth of larger vessels in chronically stimulated muscles in section seven, the author then undertakes the burden all over again in order to find out what the effects the factors mentioned above might have in growth of capillaries in heart muscle.

She concludes that different stimuli can initiate capillary growth in skeletal and cardiac muscle under physiological circumstances. Mechanical factors, according to her, are the initial stimulus for capillary proliferation in skeletal and cardiac muscle, but they might be quite different in their character and role. Luminal pressures are, according to the author, decisive in capillarization of skeletal muscle whereas a combination of the luminal and abluminal (the effect of contracting myocytes) pressure determines capillary growth in the heart muscles. The importance of the growth factors in this procedure, she concludes, is generally speaking rather equivocal in capillarization of the two muscles and remains to be further investigated in the future. This effect is, however, more equivocal in the skeletal muscles than in the heart muscles.

The qualitative analysis of the interview data

Provided that the nature of the problems to be examined in the present thesis is to reach as comprehensive an understanding as possible at how students perceive their education, how they go about their studies as well as their understanding of the learning materials, the exclusive use of the semi-structured interview questions is considered to be the best way of collecting information. This method thus comes from the perspective on which the present study is based (Marton, 1981; Larsson, 1986; Dahlgren

& Fallsberg, 1991) and was chosen on the basis of the type of information needed.

The interviews were tape-recorded and later on transcribed verbatim. The transcription formed the empirical basis the analysis.

Due to the complex nature of the issues under scrutiny, different methods of analysis were applied to the analysis of the data. The starting point in the analysis was, however, the empirical data itself. No a priori theory or frame of reference according to which the data should be classified were held.

After becoming familiar with the material through repeatedly reading them, the selection procedure followed. In this phase of the analysis, the answers to the question to be analyzed, were selected, marked and copied from the interviews (with the help of a computer) and compiled together as a separate text to work with. In this way, two empirical data bases were formed; a compilation of answers to question to be analyzed and the whole body of interviews for each participant.

A repeated reading of the statements was carried out in order for the researcher to obtain 'what is there' or the core of the comments. In so doing the main intention was to bring forth the significant similarities and differences in the statements and ignore the non-important ones. The next attempt was to find out what shared conception the similar comments had and consequently a few preliminary categories with different labels were established. The category labels or names express the nature of the shared concept held by a certain group of answers which are classified in that particular category.

After some more revision and elaboration on these categories and their names, we ended up with a set of categories which were irresponsive to further revision. These final categories are the end result of a phenomenographic investigation which describes the variation in people's conceptions of a particular phenomenon. These categories of descriptions, as was said in chapter 5, are the results of phenomenographic analysis. In this respect, Marton (1986) stated that:

> ..., ... categories of descriptions which, though originating from a contextual understanding, are decontextualized and hence may prove useful in context other than one being studies (ibid. p. 45).

The label attached to each category shows the content of the category. For a complete description of the way of analyzing empirical data in a phenomenographic way (see Dahlgren & Fallsberg, 1991).

Contextual analysis, as was mentioned in chapter 5, was developed to study the relationships between different data. In order to scrutinize the relationships between different categories of conceptions or the relationships between the conceptions within a particular category, contextual analysis has been utilized to some extent. The final analysis of the empiri-

cal data will then include both the descriptions of categories of conceptions and a study of their relationships.

Up to this point, the analysis is at the group level. Two groups of students are compared with regard to the issues under scrutiny. It is impossible to describe groups as exhaustively as individuals. In our portrayal of groups we try to include characteristics significant of the group. This implies that sometimes we have to refrain from features that are typical of an individual participant and allow for characteristics that are typical of the groups.

To give a more complete and integrated picture of the results, I decided to look at some individual subjects more closely. This should be considered as a shift in the level of description, not a shift in perspective.

Some remarks on the description of the results

The results of the empirical part of the present thesis are based on three domains. Analyzing and consequently reporting the results of the present study thus take a number of different forms.

The first domain, which includes the analysis of the answers to the questions on the content of the article, is based on a phenomenographic analysis. The results are therefore in a form of different categories describing students' conceptions of the phenomena actualized.

The second domain of analysis, including students' approaches to learning both in general and to the learning task specifically, is also based on a phenomenographic analysis. The results here also comprise different categories.

Other domains, e.g. students' experiences of their education, are subjected to a qualitative analysis of the reported experience. The way students prepare for examinations is treated in a similar way.

All the answers to the question regarding the meta-categorization of knowledge as well as the LiU students' conceptions of PBL are analyzed in a phenomenographic manner. The results are presented by means of descriptions of the categories found that represent the students' conceptions of the phenomena in question.

In the account of the results, the categories are defined with a name and presented with excerpts from the interviews. The quotations that exemplify the categories are coded with a letter (P) together with a figure. P denotes the participant who expressed the comment and the figure represents the interviewee's code number. The abbreviations GU and LiU stand for Gothenburg University and Linköping University, respectively. The word 'termers' refers to the level of the education the students are at, i.e. 'five termers' means students in term five.

As will be seen later on in the excerpts used in reporting the results, the transcripts of interviews were kept close to both the way they were ex-

pressed by the students and the spoken language. This means that the comments were not rectified in terms of grammatical mistakes and all pauses and expressions are illustrated in the comments as they were expressed in the interviews. Pauses are indicated by means of a line of dots.

It is necessary to note here that in phenomenographic analysis one can either describe individuals or the variety of the conceptions. The former means that each individual is allocated a conception whereas in the latter, different conceptions are discerned and individuals are distributed over them. It should, however, be remembered that it is the empirical material which guides one towards different paths.

All categorisation of the answers was done at the individual level, i.e. assigning each individual student a conception due to the fact that only one prominent conception is expressed by each of the participants. The analysis of the answers to the question regarding the associations made by students when reading the text created problems initially, since a variety of associations were mentioned by one and the same student. In order to deal with the problem it was decided that the associations which (a) came early in the comments, (b) were repeated several time and, (c) were very explicitly pronounced, should be considered as being characteristic of the answers. This strategy indeed worked out very well in resolving the problems in this case. It made it possible to also categorize these answers at the individual level.

The third domain of the analysis comprises the answers given to a set of questions as regards students' experiences of the university education, their expectations of the medical education, and the most important thing, if any, they learned apart from the objectives formally included in the curriculum.

More specifically, two of the questions concerned students' experiences of the university/faculty, and the last one was designed to see to what extent students thought their expectations of the medical education program were realized. Apart from the three questions mentioned above which were given to all groups of students, one question was put to PBL students, requiring them to express their points of view about the program. No corresponding question was put to the GU students.

As for the questions concerning students' experience of the university and faculty, the following procedure was carried out. Contrary to the other parts, where the answers to each individual questions were separately analyzed, this part covers answers to a pair of questions. This was done due to the fact that the answers were primarily complementary or identical. These answers were analyzed based both on the content and the attitude of the students. The same approach was applied in analyzing the answers to the third of this set of questions, namely, the question regarding students' expectations of the medical education program.

Contextual analysis was considered as a methodological possibility when trying to further investigate and analyze the findings and study the relations between some instances in the categorizations; the relationship

between approach and learning outcome as well as the relationships between other conceptions. In all the cases, the analysis was substantiated through selected excerpts from the interview transcripts.

To provide a better understanding and an integrated picture of the results descriptions of categories of conceptions, the relationships between different categories of conceptions, as well as the relationships between some specific data the results were presented by means of some individual examples.

Students' answers, which are included in a 'Residual' category, have particular characteristics in that they are neither describable nor they can be exemplified in the categories emerging from the empirical data.

The category 'Ignorant answers' contains answers where the respondents claimed to be unable to answer the question.

In the selection of the quotations included in the results, I have used two different variations. Firstly, the category is exemplified by its most developed answers. The variation within the category is described by means of different statements.

As was mentioned previously, the main purpose of the present study is both to present an analysis of the findings and to reflect some important features of educational reality that the analysis tries to describe. Following the logic of justification guiding this study, there are several ways of making sense of the world, and the empirical data included in this research, for that matter. No doubt other researchers' interpretations of the empirical data would diverge from mine.

In order to discover the extent of this divergency, the entire answers to some questions were randomly selected and given to an independent researcher completely familiar with both the methodological procedure and the research area for categorisation. The level of agreement between the categorization performed by the independent judge and my categorisation was as high as 90 per cent.

The validity of the findings is not dependent on whether or not other people do or do not agree with them, rather, their validity rests on how far they reasonably describe the reality given our own experiences and how far they will enhance our understanding of the students' ways of learning (Entwistle & Marton, 1984).

Chapter 8

RESULTS: A DESCRIPTION OF THE OUTCOME OF THE CONTENT-ORIENTED QUESTIONS

In this chapter, an account is given of students' conceptions about their learning activity and its outcome. As has been mentioned earlier, after reading the article students were given some questions regarding the content of the article. The answers, as they were expressed by students in the interviews, have been analyzed in the light of these questions. The description of the outcome of the interviewees' responses to some of these questions will be presented in the following order. The first part concerns how the students briefly described the main points of the article. In the second part, the analysis of the conceptions of the students concerning the reason why capillaries grow is presented. The third part deals with how the students carried out their free recall of the content of the article. The final part of this chapter, part four, includes the results of the last content-oriented question, concerning the importance of the information about the growth of capillaries in the medical field.

A summary of the content of the article

The first question required the students to describe the main points of the article in a few sentences and was formulated as follows: What *is it that the author wants to convey?*

Although an outline of the whole article was presented earlier (chapter 7), the author's concluding remarks are once again provided in order for the reader to be able to follow the analysis of the answers to the questions mentioned above and different conceptions expressed by the students. The author's conclusion referred to in the question is as follows:

> It seems likely that capillary growth in skeletal and cardiac muscles under physiological circumstances is induced by different stimuli. There is reasonably good evidence that increased shear stress in capillaries in skeletal muscle can initiate capillary growth by producing a disturbance of the luminary side of the endothelium. It is also possible that increased capillary wall tension due to higher capillary pressure and/or increased in capillary diameter leads to disruption of the basement membrane. These events may be sufficient to enable endothelial cell migration and consequent mitosis, and formation of sprouts. It is a matter of further research to investigate whether involvement of growth factors is necessary.
>
> In the heart, shear stress resulting from increased blood flow does not seem to be of crucial importance since capillary growth can be induced even in the absence of increased flow. Capillary wall tension is increased in hearts with long-lasting bradycardia, and very probably in hearts where capillary growth was achieved by long-term vascular dilatation, possibly due to an increase in capillary pressure. However,

> there is an additional factor- the effect of contracting myocytes. The anatomical arrangement of micro vascular bed and muscle fibres produces an intermittent distortion of the capillary wall tension, due to increased diameter and/or capillary pressure, this may lead to disruption of the capillary basement membrane and thus activation of the low molecular or fibroblast growth factors. Hence, although mechanical factors are postulated to be the initial stimulus for capillary growth in the skeletal and cardiac muscle, their character and role might thus be quite different (Hudlicka, 1991, p. 20).

The above quotation states quite clearly that there is an important distinction between the character and role the mechanical factors might possibly have in the capillary growth in skeletal as well as cardiac muscle tissue.

The extent to which the main points of the article are expressed by the students have constituted the principle behind the organization of the outcome of learning. In other words, the A conception is distinguished from B based on its completeness. This implies that the A conception includes a larger number of factors which, by their nature and together, provide the most complete answer.

In the analysis of the answers to this specific question, three separate categories have been discerned.

Category A. There is a differential effect of the mechanical factors on the growth of capillary in the heart and skeletal muscles. The role played by the growth factors is unknown

The idea in the A statements is that the mechanical factors stimulate capillary proliferation in both skeletal and cardiac muscles, but of a different nature and by means of different processes. Besides, there is some doubt as to whether or not growth factors have a positive effect on this phenomenon. This way of thinking is illustrated by the following excerpt:

> (P42) Well the author wants to express the importance of the mechanical factors for the capillary growth and there's a little doubt whether it's only mechanical factors or as they suggested that maybe in the heart there are also other factors, not only from inside the capillaries but also from muscular contractions around the capillaries and all those factors together might disrupt the basement membrane and maybe set free some growth factors from inside some sort that causes sprouting. The difference in skeletal muscles they thought that it didn't mean this, those growth factors because they had some theory they don't know is true. But the disruption of the basement membrane might allow the endothelial cells to migrate and cause sprouting by just letting them get out of the basement membrane.

As can be seen from the statement above, the student expressed the crucial importance of the mechanical factors in capillary growth in the skeletal and heart muscles as was pointed out in the article. More importantly, the participant noted that in cardiac muscles a combination of luminal and abluminal pressure leads to disruption of basement membrane whereas luminal stress may be sufficient to initiate capillary growth in the skeletal muscles.

Apart from describing the operating mechanisms in the course of capillary growth in the two muscles, the interviewee pointed out that the role of growth factors in capillary proliferation is more unequivocal in the skeletal than in the cardiac muscles.

Category B. Growth of capillaries in the muscles is initiated by mechanical and probably growth factors

As for the conceptions depicted in the B category, it can be noted that although the answers in this category are almost in line with the points the article intended to make, they nevertheless, miss part of the substantial information, namely, the variation in the role and character of the mechanical factors. In other words, the conclusion regarding the differential effect of mechanical factors in activating capillary growth in the skeletal and cardiac muscles, is not dealt with in this category. The following excerpt is an example of these answers:

> (P1) ... She wants to explain why blood vessels sprout and the mechanism behind that. And she mentions that it would be the mechanical stress and possible fibre blast growth factor ... making it possible for the cells to start to sprout.

Characteristic of the conception expressed by P1 is that the subject recognized the importance of mechanical factors in capillary proliferation in general. The subject also noted that growth factors possibly have a positive impact on this phenomenon. What is obvious from the quotation expressed by the student above is that firstly, there is no specification as to the type of muscle used in this investigation, namely, skeletal and heart muscles. Secondly, and even more important, differential effects of mechanical factors on the growth of capillaries in the heart and skeletal muscles is not spelt out in this excerpt.

Category C. Growth of capillaries is studied

The C-type answers are nothing but an attempt to mention some facts-simply restating the headline of the article.

Differently expressed, the only thing which is preserved from the content of the article is mentioning what the article was going to be about or the subject which the author was going to talk about.

Some examples:

> (P22) The author is giving a lecture on the subject of capillary growth and she's giving review on factors stimulating capillary growth in skeletal and cardiac muscle. And she's also giving her theory on the most important factors ... to stimulate capillary growth ... on these muscles.

> (P21) Hm ... the author wants to make a review of what has ... done to ... to study the mechanisms of ... eh, growth of capillaries.

(P12) Ah, the author tries to find out what guided the growth of capillaries. I think that's about it.

As can be observed, the answers presented above, although different in length and linguistic points of view, nevertheless share a very important quality. None of the them preserved any substance of the actual content other than restating the title of the article.

In summary, what can be pointed out here is that although the conceptions at the A, B, and C levels are almost located along the same dimension as the intentional content of the article was, they nevertheless differ qualitatively from each other as we move from A to B to C. The message conveyed in the article is expressed by A. B represents a qualitatively inferior level, saying nothing about the important fact that different mechanical components with different mechanisms activate capillary growth in the cardiac as compared with skeletal muscle. Those whose conception is of the C variety, evidently merely restated the problem traced by the author and provided no information regarding the answers to the problem.

Table 2 illustrates how the conceptions concerning the main points of the article expressed by the participants are distributed over the categories.

Table 2. Summary of the main points of the article

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. There is a differential effect of the mechanical factors on the growth of capillaries in the heart and skeletal muscles. The role played by the growth factors is unknown	2	-	-	2	4
B. Growth of capillaries in the muscles is initiated by mechanical and, probably, growth factors	4	4	4	4	16
C. Growth of capillaries is studied	9	11	11	9	40
Total	15	15	15	15	60

There are no students from either term 10 at LiU or term five at GU among the four participants in category A, where the differential effect of the mechanical factors on the growth of capillaries in the heart and skeletal muscles was emphasized.

Category C, 'Growth of capillary is studied' is by far the largest category with 40 students who are equally distributed over students from LiU and GU.

Conceptions of causes of capillary growth

It was mentioned at the beginning of this section that students were required to answer some questions on the content of the article which has served as a learning task in this study. What follows is a description of different conceptions of the phenomenon of capillary growth as they emerged in the answers to the question: *Why do capillaries grow?*

These notions are placed in different categories based on the nature of the factors considered by the students as being the reason for the growth of

capillaries. The structural differences between the A and B conceptions is that, the A answers contain the interplay between the environment of the blood vessels and their internal condition, whereas in the B category such an interplay is not indicated. In other words, A answers considered a combination of two aspects, namely, environmental and internal causes as the stimulating factors in the phenomenon of growth while in B category answers, environmental causes are ignored. In contrast to B-answers, where the emphasis is placed on the internal condition of the blood vessels, the C conception is concerned with the external condition or the environment in which blood vessels function. Categories B and C thus have a similar structure and a dissimilar content.

Category A. Conditions change within the blood vessels which reflect a change in the environment. These changes within the blood vessels cause them to grow

At a general level, the answers in this category contain a 'systemic' conception of cause and effect as the reason why capillaries grow. This means that the parts (blood vessels and skeletal muscles, or blood vessels and cardiac muscle), which together make the system under scrutiny, have an interactive relationship with one another. Capillaries as one part of the system are affected by the changes in the system of which they are a part. In other words, the conception which constitutes the A category conceives capillary growth as an immediate natural reaction to the disturbances caused by the mechanical components which are the indication of alteration in the external condition of the blood vessels. Put differently, growth of capillaries is brought about by the mechanical disturbances caused by the alteration in the regular state of the setting where capillaries function. Growth of capillaries is thus the consequential effect of the systemic interplay between external and internal conditions of the blood vessels:

> (P23) There is a need for a greater flow in, for instance muscles, a tissue that stimulates capillaries to grow. What it is that stimulates them it could then be either a higher flow from the beginning, increased blood flow, and then it could be that this shear stress or the wall tension increases in some way and in a heart one can then do a bradycardia, a pacing.

From the quotation above we are led to believe that this 'systemic' relationship between capillaries and the environment is considered by the interviewee. The change in the environment manifests itself in terms of 'demand' for something, i.e. 'more blood flow' according to the previous conception. This 'demand' for something, the student says, is the main initiator of stimulation of capillary growth, which in turn leads to alteration of the interior condition of capillaries. These changes are then manifested in terms of different components, 'tension in the capillary wall', 'increased blood flow', or 'increased sheer stress' in the capillaries. These different

kinds of pressure, according to the participant, are then the factors which bring about capillary proliferation.

Another variety of the A conception is the following statement which has a flavour of a quasi-Darwinian approach. It is called quasi-Darwinian because, after all, we are not talking about species and their adaptation to the environment:

> (P37) ... That ... question she tried to answer. Eh ... according to the author, they grow because of mechanical factors ... but they do grow to adapt ... to a situation ... they are forced into by altered mechanical factors ... so it's ... they grow in order to adapt to a new situation or a different situation.

As we can see, the interactive relationship between capillaries and their surrounding environment is perceived. The originator of the whole idea is 'adaptation' to a 'different situation' or 'new situation' as compared with the regular one within which capillaries exist.

Category B. Conditions change within the blood vessels

The answers in this category seemed not to have taken into account the environmental causes, but rather the interior ones as the stimulating factors for capillary growth.

Two excerpts:

> (P15) They grow because of stress, luminary stress. And because the endothelium is stressed and they release fibroblast growth factors and a low molecular. And when you have higher blood flow you also have a stress on the endothelium.

> (P3) ... Ah ... they ... ah ... grow because, different factors eh ... for example hypoxia ... ah ... stretching of the capillaries ... increased blood pressure.

In contrast to category A, growth of capillaries in the B conception is caused by an alteration in the regular internal condition of the capillary, irrespective of the reason why these changes are brought about.

Category C. Conditions change in the environment within which blood vessels exist

As was mentioned earlier, B and C categories have a similar structure with a dissimilar content. In both categories, the relationship between the external and internal condition of the blood vessels is ignored. What distinguishes these statements from the B category is therefore the content of the statements, not the structure.

> (P2) ... Because they need a supply of oxygen or supply of blood. Oxygen energy metabolizes.

(P9) ... Because of an increased need for blood supply I think.

(P38) ... to supply the tissue with more oxygen.

The comments in this category are at a general level characterized by a theological view of causality. A notion of this kind holds the purpose of an event to be its main cause. As can be seen the first example above assumed that capillaries grow to fulfil several demands whereas in the last two statements a 'finalistic' conception of causality (Piaget, 1930) is applied, i.e. the final stage of a course of events is conceived as the cause of the event.

Category D. Ignorant answers

This category contains only one answer. A sense of uncertainty regarding the causes of the growth of capillaries can be detected in this answer. This student gives a convenient description as to what he or she assumed to be the causes of capillary growth, at the same time as he or she argues that the question is impossible to answer:

> (P 57) Because there is a need for more capillaries ... why they grow, because you would assume that, before starting to read the article that it was an increased demand for, for something, oxygen for example ... but since oxygen does not seem to be the cause of increased capillary growth ... I'm not quite sure why that happens, ah ... - I mean, the meaning of having a vascular supply is that ... ah ... the vascular system delivers oxygen, nutrition, etc. to various tissues ... so that is the ... and also it takes away ... ah ... metabolizes of, of waste, sort of transports that away from the tissues ... ah ... so ... in the capillary growth ah ... to me it seems that well, it has, it has to be an increased demand for capillaries, but ... ah.. that's what I think ... but it doesn't actually say in the article. ... Ahm ... I think that it seems to be more of a ... the answer to that question is probably more illusive than what we imagine ... it's not so simple as to say that well, it's because we need more of this or it's because we need to get rid of more of that ... because it seems that we already have quite a good vascular supply, so ... I don't know really.

An overview of the distribution of answers regarding the causes of the capillary proliferation is given in table 3.

Table 3. Conceptions of causes of the growth of capillaries

Category	Number of students (n=60) LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Conditions change within the blood vessels which reflects a change in the environment. These changes within the blood vessels, cause blood vessels to grow	-	1	1	1	3
B. Conditions change within the blood vessels	10	7	8	8	33
C. Conditions change within the environment within which blood vessels exist	4	7	6	6	23
D. Ignorant answers	1	-	-	-	1
Total	15	15	15	15	60

The A category has 4 statements none of which were given by LiU five termers. The B category contains the largest number of conceptions equally distributed over different groups of participants except for the LiU five termers which contains more answers.

Outcome of the free recall

In this part, the result of the free recall of the reading task is presented. The chief concern here is to find out the differences and similarities in how the article appeared to and was interpreted by the participants. Differently expressed, the interest here is not to present the amount given in the recalls by the subjects in a quantitative sense but, rather, the structural properties of the 'what' of the learning material - in this case, the article in question - conceptualized by the participants. In other words, the 'what' of the actual content preserved by the participants, as well as the differences and similarities between these perceptions, is the major interest here.

It is necessary to point out here that no specific demands as to order of appearance of the information in the recall is considered.

The analysis of these recalls yielded three main categories. What distinguishes A answers is that the participants in their recalls in one way or another not only talk about the involved factors in the growth of capillaries in both skeletal and heart muscles but also point to the fact that the contributory factors do not have the same character and role in the capillarization of the above-mentioned muscles. Although varying in linguistics, the answers which belong to this category, nevertheless, include the concluding remarks concerning capillary growth.

Category B consists of the answers which described and discussed the factors which contribute to stimulation of capillarization in both heart and skeletal muscles. Some of the answers, although pointing to the difference between heart and skeletal muscles when it comes to capillarization, were nevertheless, put in this category. The reason for this is that these answers do not refer to the "actual" differences between these two muscles. What is meant by the "actual" differences will be further discussed in the section where category B is described.

In C answers, stress is laid on pointing out some factors which are involved in growth of capillaries.

Briefly, there is gradual exclusion of the important principles as we move from the first category to the second and third. In other words, the A answers are qualitatively different from the B answers in that they preserve the actual structure of the text. In B statements one of the main points of the final conclusion fades away. In the C category nothing is expressed but some explanatory comments from the whole conclusion.

In short, this result is very much the same as the result achieved in the first part of this chapter where the students were asked to describe the principal points of the article.

Category A. Two kinds of muscles tissue and also two corresponding kinds of mechanisms

The stress in this category is based on the fact that the mechanism involved in capillarization in the heart is different from that of the skeletal muscle. This means that the participants pointed out the problem the author was trying to resolve and provided us with the necessary description, explanations and examples. More importantly, they expressed the major substance of the actual content, that is, in the two differing types of muscles, there are two differing mechanisms of mechanical pressure at work when it comes to stimulation of the capillaries.

Below is an early part of an example of the A answers, where the student starts to talk about what the article was about:

> (P2) ... First I've read about how they think that vascularization is made in skeletal muscles and they discuss first that vascularization is

> not so very common in other physiological circumstances. ..., ... they have studied certain models where they first thought that hypoxia was involved then they studied if hypoxia was a single factor they studied it with reduced flow and there was no new vascularization then. Then they thought hypoxia is not a single factor ...

As can be seen, at the very beginning the participant not only introduces us to the problem the article was trying to examine but also makes it clear that the information is going to be about capillary growth in skeletal muscles. The student then deals with the influence of hypoxia on capillary growth in the skeletal muscle and indicates that hypoxia in itself does not initiate capillarization there.

It is interesting to note here that the effect of hypoxia on capillary growth has been controversial for a long time. It was believed that hypoxia initiates capillary growth in skeletal muscle, something which is convincingly refuted in this article (see the summary of the article in this chapter as well as chapter 6).

Below, is an excerpt where the interviewee deals with the impact of growth factors and the mechanical factors, i.e. wall tension, and shear stress in the skeletal muscles. The student concludes that the role of growth factors in capillary proliferation is unknown but that the mechanical pressure on the luminal side of the capillary endothelial cells causes rupture of the basement membrane and leads to a capillary sprout:

> (P29) ... About the growth factors you see when healing a wound, I don't really remember that much about it, but in the end I can remember more research. So the role of growth factors are not entirely known. ..., ... Then to mechanical factors. In skeletal muscles the two most important things for capillary growth, there is shear stress, defined as in one part of the article anyway, as a higher flow of red blood cells that will induce deformation of the luminal side of the endothelium. Then wall tension, increased wall tension, due to increased blood pressure or increased capillary diameter. These two combinations will lead to basement membrane rupturing and maybe that will then cause sprouting and mitosis and new formation of capillaries, and the role of growth factors is then not known entirely.

Next, is the final part of another example of this conception where the student expressed what he or she remembered from the learning task:

> (P46) ..., ... But the difference in between is that they can't really find that there is a need for increased flow in the cardiac to make capillaries grow. And ah ... so in the skeletal muscle there will be luminal stress, in the cardiac muscle it's more like the abluminal stress from the outside with the muscle ah ... with the heart muscle acting on the outside of the capillaries. But then in the end it will have the same effect on the endothelial cells making them ... stretching them, making ... hurting the basal luminal. Creating maybe releasing factors that make capillaries grow and inducing migration and proliferation of endothelial cells.

As is evident from the above recall, the conclusion drawn concerning mechanisms involved in capillary growth in the heart as well as skeletal muscles is very much in line with the remarks presented by the author.

Although the article dealt with a lot of description and explanation of different experiments, still, the student was able to distinguish means from ends. This means that this student perceived what was significant, through integration of parts by means of organizing principles. By doing so - putting together the pieces of related information - he or she was able to draw the general conclusion the article intended to bring forth.

Category B. A number of possible explanations are given and discussed

A presentation and discussion of the contributory elements in capillarization in both the heart and skeletal muscles is a distinctive feature of the conception in category B. Here, in contrast to the A conception, the interviewees do not include the final conclusion presented in the article, that is, the distinction between the function of the different pressures in the two muscles.

Below is an excerpt of an interview illustrating this way of recalling the information where the student indicated no difference between capillary increase in heart and skeletal muscle:

> (P1) ..., Then she has tested hypoxia and she says hypoxia does not result in more growth. Then it's about mechanical factors and that shear stress causes growth and also if you have a high blood rate flow and more growth also wall tension will make the capillaries grow. She has also tested the growth in heart muscle and it's very rare with the sprouting in the heart. She says in bradycardia you get more sprouting because the diastolic time would be longer and during diastolic you've got more blood-flow through the capillaries and the wall tension is higher. Then you get more capillaries than in the control group ..., ...

This category, as was mentioned earlier, is a puzzling one in that in some answers students stated that '*there is a difference between heart and skeletal muscles when it comes to growth of capillaries*', but their answers, nevertheless, do not belong to the A conception. This is due to the fact that they are either ambivalent in bringing forth the nature of differences, as in the following example:

> (P56) ..., ... So she states that for skeletal muscle there is no importance of hypoxia or any growth factors ... but ... eh ... mechanical stress ... for instance from increased flow and the change, the mechanical change in the endothelial cells and also the, on the luminal side is what initiates the budding, there is a sort of a rupture in the basal membrane, starts eh ... the budding of the capillary ... Anyway, the conclusion regarding at the cardiac capillaries, is that the mechanical stress is not enough ... so in the heart there are other mechanisms which starts capillary growth, than in skeletal muscle ... but maybe the mechanical stress also has a role to play because from the mechanical stress there could be release of different growth so from what I un-

> derstood, in the heart there, there's a need for growth factors either from the endothelial or from, from fibre blast closer to the basal membrane. And exactly what is the, exactly what ... what it is that release these factors he doesn't know, but these factors are needed in, in the heart but not in the skeletal muscle.

As can be seen in the above quotation, although, the student pointed out that ...: *'in the heart there are other mechanisms which start the capillary growth'*, he/she, nevertheless, gives us a convincing reason to believe that he/she did not grasp the 'actual' distinction by saying that: ... *'the conclusion regarding the cardiac capillaries, is that the mechanical stress is not enough.'*

One interpretation that immediately suggests itself is that the student meant that some factors other than mechanical ones are necessary for sprouting of capillaries. What these other factors are, however, has not been indicated.

In order to show that the above student confused the 'actual different' - type and the mechanisms of pressure - with one of the contributions of the extra factors, it is necessary to once again refer to the content of the article. It should be remembered that in the conclusion the author pointed out that capillary growth is stimulated in heart and skeletal muscles by different mechanical stimuli. What differentiates heart muscles from skeletal muscles in this respect is that in the heart a combination of pressures (luminal and abluminal) seemed to be of importance. These might lead to rupture of the capillary basement membrane and activation of fibroblast growth factors and possible capillary proliferation whereas in the skeletal muscle, pressure on the luminal side of the endothelium could lead to rupture of the basement membrane. The end result of this event could be possible migration of endothelial cells and subsequent mitosis, and inception of sprouts. The role of growth factors concerning capillary increase seems to be more equivocal in skeletal than in heart muscles.

In some answers, the 'difference' between the growth of capillaries in heart and skeletal muscles is expressed in terms of different roles of growth factors:

> (P6) ... This pressure that increased it also increases capillary growth. For the heart muscle they increased the flow but capillary growth wasn't as significant in a heart muscle as a flow was in a skeletal muscle. So they thought more of some kind of growth factors involved in shearing and tearing the endothelium released some kind of growth factor that was more important in the heart for capillary growth. That's a summary of what I think is important.

In some answers, a distinction is made between capillary growth in heart and skeletal muscles in terms of different kinds of experiments which implies that capillary proliferation is stimulated like:

> (P39) ....To conclude again what I've already said, more clearly, you can induce ... capillary growth. This they have showed and if you want to do it in the heart, you can not do it in the same way as in the skeletal muscle. The most effective way to induce capillary growth in a skeletal muscle, is to increase blood flow ... basically by giving beta-blockers ... and if you want to do it in the heart, it would be very effective if you could induce ... bradycardia. ..., ...

Category C. A number of possible explanations are given

The core content of the answers in this category is pointing out some of the factors considered to be of importance in capillarization in general. Compared to the B and A categories, in these answers, two important elements of the conclusion the author presented have been omitted.

This way of recall is shown in the following quotation:

> (P 45) ... well, she started by a resume ... of the historical ... investigations in this area ... in the last century ... she described a lot of different steps and she ... well, eh.. knowledge of this area ... and then ..., and then she goes on to describe the physiological ... growth of capillaries ... under different circumstances which has been a bit difficult to show because ... isn't much ... and there are variations in different tissues ... for example in the brain in skin ... turnover is ten ... thousand days ... but in ... like the liver ... in the kidney, I think it's much faster ... eh ..., ... Of course the situation in children is different. And because they have looked in ... more into ... to ... regeneration ... under pathological ... situations and ... during development and in the normal adult. - Eh ... from this part I also remember how they recognize where the capillaries are ... they use ... specific enzyme. alkalis phosphates ... and different types of muscles for ... for doing because capillaries in muscle ... oxidative and fast and slow ... nothing ... different enzymes studies of capillary growth on ... on high altitude in endurance training and I think that Eh ... ... then it's the role of ... metabolic factors ... capillary growth ... and what I remember is oxygen ... she shows that it's probably there ... that there might be some growth factors but and then she goes on ... mechanical factors yeah and that's ... one of ... the ... there is a conclusion I didn't understand too much of the techniques she didn't ah ... the ... blood flow ... ah ... they have found that increasing blood flow is ... connected to increased capillary sprouting.. but that might be ... connected ... to the ... mechanical effects of a blood flow ... well, I think that was ... superficially or ... used a lot of experiments. Five or ten experiments. ... perhaps more ... Yeah ... support eh ... difference. I liked her way ... she started each by ... describing ... investigations ... and what was the ... kind of a concept at the time ...

As can be seen from the above excerpt, almost half of the recall contains some information about different ways of demonstrating proliferation of capillaries in the tissues and the turnover time of capillary endothelial cells in different organ tissue. From the second half of the statement, the participant pointed to the positive effect of the oxygen and blood flow in capillary growth, saying nothing about the type of muscles he/she refers to. Nor does the student talk about other contributory factors and their role in this phe-

nomenon. In other words, what is said in this recall is some factual information and the effect of two factors in capillary growth in general.

In conclusion, if we once again look through what was essential in the A conception, three structurally different principles present themselves concerning 'what' is remembered from the learning task: a) that there are a number of possible explanations as to what makes capillaries grow. b) that these explanations are discussed and, finally, c) that these explanations are evaluated and a plausible conclusion regarding the contributory factors in the growth of capillaries and its underlying mechanisms in the heart and skeletal muscles is provided.

What is preserved from the above-mentioned structures in the B answers is point (b). The C conception, on the other hand, contains only the first point or the (a) principle.

The table below shows the distribution of the answers based on the analysis of the free recall of the learning task.

Table 4. Results of the free recall of the article

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Two kinds of muscle tissue and also two kinds of mechanisms.	2	3	2	5	12
B. A number of possible explanations are given and discussed.	11	12	12	10	45
C. A number of possible explanations are given.	2	-	1	-	3
Total	15	15	15	15	60

The B category, stands out as the most prominent conception with very small inter/intra group differences. There are no ten termers from either of the two universities among the C answers.

The relationship between biomedical knowledge and medical care

It was mentioned earlier that some questions regarding the content of the article were discussed in the dialogues between the students and the author after the subjects had finished reading the article which was used as the learning material. The result to be presented here is the analysis of the answers to the last question in this respect. We used this question to ask about the existence and nature of the relationship between biomedical knowledge and medical care. The interviewees' answers have been analyzed in the light of the following question: *What role do you think this kind of knowledge plays in the medical field as a whole?*

In the analysis of the respondents' statements as regards the role of the information about the growth of capillaries in the medical area, all reflections can be placed in any of the four categories. In other words, the conceptions are not structurally different but are horizontally summarized in different categories. A fifth category represents the ignorant answers.

Category A. Knowledge is important because it provides the prerequisites for developing technology

What this conception implies is that, here, understanding the principles as regards capillary growth is seen as one step towards treatment rather than the last step to it. Differently expressed, the answers which fall into this category perceived that the information concerning capillary proliferation could be used in developing some new methods or devices if they are to be used in the treatment of the patients.

Two excerpts:

> (P26) I think it's quite important. Because in the western world cardio ... cardiac diseases and the cardiovascular diseases are such a big problem ... And to reduce ... mortality it's important to find ... both ... to decrease the risk of people getting these diseases ... but also to find better cures for the people who already have the diseases. It's important to know then may be you can use either drugs that release these growth factors ... or maybe you could produce the factors ... themselves. So I think it's important knowledge.

> (P16) ... You could give them some medicine to make new capillaries grow, so they will have blood flow to their heart or to different part of the body. In diabetics where they have problems with their capillaries in the periphery. So it's of great importance I think.

We can see in the two quotations above the idea of using the knowledge about capillarization available in the article to help towards manufacturing drugs to be used in both prevention and treatment of diseases.

Category B. Knowledge is important because it is technology

Here, unlike in the A conception, the principles behind capillarization presented in the article are assumed to be the last step - the medication itself. The answers which belong to the B category are the ones which assume that the information available in the article is important in several medical fields. The positive role of the knowledge about the principles behind increasing capillarization are described in mainly general terms and lack a pronounced, specific content about how or in what way:

> (P1) I think it's very important in people with heart disease and how you can make more capillaries in the tissue, in hypertrophic hearts. So there won't be any ischemia and angina, I think that's a very important thing.

> (P2) This is basic science in this article and I think that could be useful ... mostly in oncology in tumour treatment the knowledge about how tumours can survive and grow and how they can I can think it has many applications even in surgery, general surgery and transplantations.

Category C. Knowledge is an end in itself

Contrary to the previous answers, the statements of the C variety assumed that the information which is provided by the article is important to know for its own sake and not for any other reasons:

> (P34) ... But ... the ... these kinds of articles is what I think ... a lot of people read, just to know, review, what has happened in capillary growth research ...

Category D. If knowledge is not of any practical use, it is not valuable

The category E answers are characterized by doubt as to whether this information has a positive role in medical fields or that it lacks any effect at all. Some excerpts:

> (P41) ..., ... I don't think it ... it is so important ... for ... the average ... doctor, I think.

> (P30) ... if I'm a doctor ... physician ... and now working today with my patients ... it doesn't really matter ... at that point ... if I'm talking about his high blood pressure ... ... or whatever. I ... I don't think it would help me in knew this ...

Category E. Ignorance and restatement

The statements belonging to the E category either the restate the question or repeatedly discuss the fact that they do not know what the importance of the information could be. An example:

(P53) I don't know. Not so much in this case. I think they have to find the growth factors to handle this problem, but I don't know. This kind of ... I think they have to find the growth factors. I mean to use this in practice ...? It's just a basic research. I don't know.

The distribution of categories of conceptions with respect to the relationship between biomedical knowledge and medical care is shown in table 5.

Table 5. The relationship between biomedical knowledge and medical care

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Knowledge is important because it provides prerequisites for developing technology	2	7	1	2	12
B. Knowledge is important because it is technology	8	4	12	10	34
C. Knowledge is an end in itself	2	3	1	1	7
D. If knowledge is not of any practical use, it is not valuable	1	1	1	1	4
E. Ignorant and restatement answers	2	-	-	1	3
Total	15	15	15	15	60

More than half the answers are allocated to the B category of which the GU term five has the largest share and LiU term 10 has the smallest.

A prominent characteristic of the answers is the positive role of the information the article contains in treating heart ailments or heart problems in combination with other diseases.

Chapter 9

RESULTS: APPROACH TO A LEARNING TASK

As was indicated previously, medical students were required to read an article and after reading it they were given some questions about the content of the article. The results were presented in the preceding chapter. After having answered the content-orientated questions, a set of questions concerning how the students read the article in the particular situation was posed.

In this chapter, a description of how the students actually approached the article will be provided. This kind of information on the context in which the learning took place is of particular interest when determining and interpreting the learning outcome. The students were asked, for example: *Could you tell me how you read the article?; Did you use any specific technique while reading the article?*; and *Did you think about anything which was not in the article?*

In this chapter, the analysis of the answers to these questions will be described in the same order in which they were presented above.

The process of reading actually experienced

The answers as regards the question: *Could you tell me how you read the article?* have been analyzed. The results reveal four categories which are of differing quality. The distinctive characteristics of the conceptions lie in how the students approached their learning task. The categories to be described are a description of what the participants have said about the way they acted when reading the article; 'how reading is carried out'.

Category A. An investigative approach to learning

The students in this category apply a kind of discovery procedure which consisted of two intertwined intentional elements. The ultimate goal in this procedure is not just striving to get at the overarching theme of the article but, equally important, to critically examine what they were reading in the light of their previous knowledge:

> (P1) ... and then ... when I had got what she wanted to tell me about ... I started to search for that and ... yes, and ... I checked it with my own ... of course that little experience of this field, but ... was it the same as I read before?... and was there something in this text that I knew about? A little bit more so I can make some kind of ... some kind of ... is this correct or is she trying to . convince me about something? That I ... don't like, I mean ... if they write enough much ... and very ... authoritarian ... don't know ... eh ... and you can make me believe every-

> thing and I just checked that. It sounds ... OK, it sounds ... it's about something I've learnt before ... it could be correct. And that the methods were ... if it is possible to ... use that kind of enzyme to ... say that you have that kind of cell well, searching for all the ... false information ... eh ... it's not false ... eh ...

What can be read from this excerpt is that the student engages in a more active dialogue with the text. At the very outset of the reading activity, the participant attempts to figure out what the article was going to be about. After having found out what the core content might be, he or she no longer talks about it and instead concentrates on asking him/herself questions of the kind: *'how does this relate to what I already know?'; 'is what she says correct or is she just trying to convince me in an authoritative manner?'* and in doing so tries to form a judgement about the content he/she is dealing with in the light of his/her previous knowledge and experience.

P3 is another example of this mode of dealing with the reading task. What is focused upon here is to see whether there was any logical gap in what was presented in the article:

> (P3) ... and as I said if I don't find ... some things I didn't understand or find logical then it was difficult to understand that part. But when I could ... when I thought it was logical and ... it was much easier to read I read it faster.

Category B. A comprehension-directed learning approach

B is a category which contains a group of participants who tried to identify what the main message of the article was. The statements given by these participants are merely a description of the pattern they followed in order to obtain the principles the article contained and nothing more. What then differentiates category A from B is that in the A statements students are searching both for the theme of the article as well as critically investigating the information presented to them in the light of their previous knowledge and experience as regards capillary growth, whereas the description given in the B answers is an attempt to achieve the former goal only. In other words, what the B activity brings about is what the author wanted to say whereas the A approach tries to make a commitment to the new information and hopefully add something to the actual content. An example:

> (P2) ... I try to find out the conclusions and I try to not ... yeah, just trying to find out what the conclusions are and not all the ... the details and ideas of what maybe and ... a lot of questions in the text, I try to ... at least try to read that more quickly and just find the conclusions the author has made, or other authors have made.

Category C. An atomistic approach

In contrast to the A and B categories, the characteristics of the responses belonging to the C category are that an active and reflective attitude towards the content of the article is lacking. The participants instead focus their attention on understanding the content of each separate part of the article:

> (P11) Well, eh ... first I looked it through ... quickly and I ... read the sub-headings ... and then I read each ... ach part ... and ... while I was doing that I underlined ... some important ... words ... and sentences ... and after each part of the text, I ... I wrote ... it down on my paper ... the things that I thought were important ... for this ... and then I took the next part ... and did ... did the same ... and so on.

> (P14)) Eh ... first I made a preview, I looked at all the headlines on the sections ... I read the introduction and I like ... I looked for the ... conclusion. ... I didn't see the headline conclusion and then I ... I just skip that ... eh ... normally I would like to have read the conclusion first. Eh ... then for each question I read ... section and after that to make notes. About ... things that I was ... I thought were important. Eh ... in the beginning I made notes ... more notes ... more detailed notes ... and then I began to understand I couldn't read ... everything ... I ... I just ... made notes about the important thing in every section ... one sentence about every section ...

From the two quotations presented above it seems as if each separate section of the article was assumed to be in itself a main theme and not a part of the whole content. Consequently, students tried by memorizing the important parts of each section to understand the overarching theme of the text.

Category D. A study technique-directed learning approach

Contrary to the above three categories in which the emphasis was on the covert cognitive activities, the stress in this conception is placed on the overt technical processes. The answers classified in this category describe what kinds of techniques, i.e. underlining, note taking, were used when reading the article. Students do not mention anything about the content they were dealing with or about what they were looking for in their reading. Differently expressed, criteria of approach to learning are externalized in these answers. Some excerpts:

> (P56) I read it straight through and I underlined with a yellow pencil. Then I wrote down some words, not as much as you go back and read them later, just because writing them makes me remember a bit. To distinguish certain main words.

> (P31) I read it through and underlined things I found important.

The table below shows the distribution of the categories based on the analysis of the way the students read the article.

Table 6. Approaching Learning material

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. An investigative approach to learning	3	1	1	-	5
B. A comprehension directed learning approach	7	8	6	8	29
C. An atomistic approach	2	2	2	-	6
D. A study technique directed learning approach	3	4	6	7	20
Total	15	15	15	15	60

The A category is the smallest one with 5 answers, none of which were given by student from GU term 10. Category B is the largest category with 29 interviewees, followed by the D category with 20 answers. Category C contains 6 students with 2 from LiU term five, 10 and GU term five. No participant from GU term 10 is placed in this category.

Learning skill actually applied

As described earlier, a group of questions were put to the students regarding how they actually read the article in order to gain some insight into students' perceptions of the circumstances under which they engaged in reading as well as how they proceed in their reading activity. Since one of the major questions the present study attempts to further investigate is whether or not the educational context or mode of instruction influences the students' learning approach, this kind of information is of vital importance.

Learning is a procedure carried out by someone in some kind of context. It can be best understood in the light of the nature of the context in which it is carried out. In other words, the learning activity is determined by the learners' perceptions of the context of learning, and how they perceive the contextual components determine how they accomplish the learning activity. The latter will in turn determines the quality of the learning outcome. (Marton et al., 1984; Biggs, 1989).

The first section of this chapter contains a description of how the students actually read the article.

First, the participants were required to describe the kind of study skill they applied while reading the article. The answers to be analyzed are then the responses to the following question: *Did you use any specific technique while reading the article?*

The analysis resulted in two different categories. Conception A describes how students tried to organize the content of the article. B category comprises those statements which merely deal with the mechanical action directing overt study behaviour towards the article per se, i.e. underlining the text, note taking and the like.

Category A. A non technical-directed process of learning

When talking about the kind of technique the students applied while reading the article, the statements do not contain the overt kinds of activities like making notes, reading speed or underlining in the article. They instead describe how they organized the content of the article, sorted out the information, compared the new information with the previous information, and even tried to evaluate the level of their knowledge to see whether they could question the author:

> (P1) ... I read as I always do ... I'm quite quick at sorting out all the ... names of her references ... I always take them away, until if I found something very interesting I can go back ... and search for that and check the ... the reference list at the end ... if there are good ... pictures or diagrams I can look at them, ... If they tell me more than a ... the text will do, ... - And of course then I had to just accept her, but I feel that I don't have that much knowledge in her field so I can question her or try to find out new things about from all the ... tables and I was searching for something that was ... of course I'm searching for something that I already know, and that can give me feedback that I had read ... right before ... I didn't feel that motivated to ... to learn about ... just stop ... I mean it's like we have articles in our tests ... after each half year ... and ... I used something like that kind of technique, I mean I just ... read it and then I ... when I don't feel that I have to learn about it, I just try to get the point of the article and then if I ... find it very interesting I can always go back.
>
> (P3) .... and try to understand the meaning, the logic ... this part was difficult to understand.

As is evident from the excerpts in the case of the answers classified to category A, goal and means are not separated.

Category B. A technical-directed process of learning

The statements allocated in this category are totally different compared with the ones classified in the A category. Contrary to the A answers where the students do not differentiate between the intentional and functional (practical) components of the reading activity, B answers focus on the techniques normally used by the students such as underlining, reading speed and so on:

> (P 2) ... it's about like this ... when we have examinations and we have to read such articles I first read it quite quickly and I underline and then I go to the questions we have and then I look again. Because then I have to find out the answers for the questions and then I look again at the most important parts, but ... I don't know if this is a special technique but ...
>
> (P19) No ... using the pens, the ... the yellow and red ones and also ... the other one but I ... no other techniques.
>
> (P20) Underlined and then tried to on a ... a note block ... beside, I took eh ... one page ... of notes. - And it's mainly subtitles and the conclusion of the subtitles.

Category C. Ignorant answers

The answers in this category indicated that the interviewees do not use any specific technique. An example of this conception is shown below:

> (P22) No, this is the technique I use, so it was ... reading the article.

Table 7 illustrates how the answers to question regarding whether or not students chose any particular study technique are distributed over the interviewees.

Table 7. Question: Did you choose any specific technique while reading the article?

Number of students (n=60)

Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. A non technical-directed process of learning	3	6	5	3	17
B. A technical-directed process of learning	7	3	6	12	28
C. Ignorant answers	5	6	4	-	15
Total	15	15	15	15	60

Category B is the largest category with just under the half of the whole number of participants of which 12 are GU ten termers.

The nature of the associations made by the students during reading activity

Students' statements about how they read the article as well as the kinds of study technique they used while doing so are described in the two preceding sections of this chapter. In this section, the nature of the associations, as expressed by the participants, is presented.

The main basis of the description consists of the answers to the question: *Did you think about anything which was not in the article?*

In the analysis of the answers to the question mentioned above, some problems emerged due to the fact that many answers contained several different associations expressed by one and the same person. Is there any particular category that is characteristic of the answer? Efforts have been made to make a decision in this respect for each participating individual.

Three criteria were established and applied in analyzing the data at the individual level. According to these criteria, the degree to which the associations are considered to be of significance, depends on:

- their early order of appearance in the answers
- repetition of the associations
- and that the associations are explicitly emphasized

This strategy indeed appeared to work very well in resolving the problem and made it possible to categorize individuals. The analysis of the answers led to three main categories.

In order to better understand the nature of differences between these conceptions, some remarks must be made here. In any learning activity, the most important and relevant association as regards the learning process is the association which relates to the content of the learning and then the associations concerning the context of learning, if we are to understand how learners in general and our participants in particular made sense of the content they were reading. This implies that other associations become even more irrelevant and insignificant in relation to the learning process.

Category A. Content-oriented associations

This category subsumes the answers in which students were thinking about the content of the article while reading it. From the quotations which can be placed in this category, we move from the students who thought about the content of the article, and their previous knowledge to those who thought about the application of the knowledge available in the article. Some examples:

> (P1) Not more than I ... tried to recall my ... old knowledge ... but I don't ... of course that wasn't in the ... exactly in the text but I think it was ... I mean the text made me think about it ... but it wasn't ... stressed out, I mean she didn't write about ... some of the other growth factors I was sitting thinking about ... they could have done this ... and ... I was thinking about ... the way and that wasn't mentioned ... actually in the ... text either ... so I was thinking about that ... sometimes I thought about ... if you were allowed to use ... for that kind of ... we have had. Lecture today it isn't what she was saying ... but ... and ... so I thinking about that. Alkaline Phosphate, it's ... it's an enzyme that ... break down things and ... she said it was specific for endothelial cells and I had heard something different from that ... in the morning now, so I was ... thinking about that, but ... I didn't stop and start thinking about something different, absolutely ... different from the text, no, I didn't.

> (P8) ... I've ... I ... looked eh ... through the article ... and ... eh ... normally there is a summary ... and a ... conclusion ... ... but there wasn't any in this ... article, so eh ... I read it through. And ... like I said before I skipped ... numbers and names and so on. - And just concentrated mainly on conclusions ... all the way.

Category B. Context-oriented associations

The B answers are the ones where participants do not think about the information presented in the article or anything as such, instead they are concerned about the peripheral things which, although they have nothing to do with the content they were reading, cannot be categorized as completely irrelevant:

(P7) ... Uh ... and then a door slammed out here like this so one lost one's concentration. But I ... well ... I kept, well, otherwise I read in a pretty concentrated way, unusually concentrated I must say. It was ... more than perhaps ... well, normal, if there is anything called normal.

(P32) ... No, I just concentrated on the article. I was thinking about the time, looking at my watch to see how much time there was left.

(P3) Yes, I thought it was a long article ... and I wondered ... how much is there left. ...

From the three quotations it can be seen that the issue of *'being concentrated'*, *'time'*, and the length of the article were main concerns of students during reading the article.

Category C. Extra-content, extra-context oriented associations

Students whose answers are of a C nature, as can be seen in the following examples, made no association whatsoever as to either content or context of the learning material.

(P27) ... I was thinking of completely other things. I was thinking ... about ... what I was going to do next week and such private things.

Category D. Ignorant answers

In this answer, students made no association while reading the reading task.

(P31) No.

(P51) ... I can't remember anything special.

The distribution of answers to the question of the nature of association while reading the text is shown in table 8.

Table 8. Associations

Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
	Number of students (n=60)				
A. Content-oriented associations	6	3	4	3	16
B. Context-oriented associations	9	9	6	8	32
C. Extra-content extra-context associations	-	3	4	3	10
D. Ignorant answers	-	-	1	1	2
Total	15	15	15	15	60

A clear majority of the students, just over half (n=32), made context associations while reading the article. None of the participants from LiU term 5 is included in category C. Category D contains 2 students from GU.

Chapter 10

APPROACHES TO LEARNING IN THE EVERYDAY STUDY SITUATION - STUDENTS' REFLECTIONS

In this section we aim for a description of what kind of approach students apply in dealing with their learning materials in the normal daily study situation. The data regarding this issue were obtained by putting the following questions to the students: *Do you put any question to yourself while reading?; Do you memorize certain things more than others?; How do you prepare yourself for the examination?*

The results to be reported here are an analysis of the responses to the above-mentioned questions which have been analyzed separately and will constitute three different sections of the present chapter. The results will be reported in the same order as the questions were presented.

The way students read their course materials

This chapter continues by reporting the results concerning the first question; *Do you put any question to yourself while reading?*

The analysis of the answers yielded five different categories. What differs is the nature of the questions the students asked themselves. In three of the categories, students ask themselves questions whereas in the fourth other people are asked. In the final category, the interviewees do not ask any questions at all while reading.

Category A. I ask critical/analytical questions

In category A, the interviewees indicate that they consider two aspects while reading a text. One of these aspects concerns the understanding of what they were reading. Evaluating the reading material also appears to be just as important in their reading activities.

Some excerpts:

> (P2) ... Well there could be questions like, have I really understood this? What did they mean or could this be true? Does it fit in with what I've heard before? What are their methods, are they OK? Do they seem to be possible to do again? Or are they just crazy? ... or is this important for medical research or is this ... or no one's gonna read it and use it.

> (P42) ... Yes, always ... if there's some conclusion ... conclusion in the text I always ask myself ... eh ... why does it have to be this way ... and try to find the answer. - So I always read the text very critically.

> And I always remember ... when the postulation differs from another book or text or ... from a lecture or anything. I just have to, try to find out what is true.

> (P25) Yes ... I do Ah ... I did so more before than I do now. Before I put questions if I didn't get the context in general. If it was. ... the discussion was leading somewhere but it was not really a conclusive discussion, which gave a sequence. But rather he was talking about things. Now I just skip it, and try to find the mechanism somewhere else ... But in general I ask myself, where is this leading? If the discussion contradicts my own opinions or if it is just blurry, and then I just skip it nowadays. I don't try to put it straight.

The idea in the quotations is that in a reading activity understanding of what a text is about as well as deciding how to make sense of what one was reading seem to be considered by the students. It is interesting, however, to note that student (P25) indicated that he or she had changed his/her way of reading over time, although the reason for doing so was not clearly stated.

Category B. I ask myself questions about relevance

The relevance of the information is emphasized in category B. The answers in this category say that the students' concern while reading is to find out whether or not what they read is important with regard to their field of education.

Some statements:

> (P15) ... Yes, I do that to extract what is important from the text and if there are things I should know, then I do that.

> (P35) ... Yes, eh ... I'm ... lazy by nature ... so I always ask myself is this really important ... do I really have to learn this? What is important? What is important, what do I want to ... know, from this? ... book chapter or article.

Category C. I ask myself if there will be any questions on this in the examination

The importance, according to the conception in category C, has to do with whether the information is useful for the examination.

In other words, the questions the students posed might be what information is important with regard to the examinations.

Two excerpts:

> (P7) ... seldom. Questions that I think they are going to ask me in the examination and that would be almost everything.

> (P13) ... Those I have seen in old examinations. No, I don't formulate questions to myself, no, I don't. But if I have seen an old examination question about the incidence of neoplasm. When I read about neoplasm, I underline incidents and I write it down on a piece of paper so that I will remember. ,

While the first of the two quotations above shows that when reading study materials, students concentrate on figuring out what questions he or she might get in the examination, in the final excerpt the opposite is the case: Previous examination questions were indeed the determinator of the reading activity.

Category D. I ask other people if I do not understand what I read

Contrary to the previous three categories where the students stated that they ask themselves questions, in the D category the students ask other people questions.

This idea is illustrated by the following examples:

> (P26) ... Yes, sometimes. If there's something I don't understand I usually write it down and ask some friend the day after. Or when you are reading for a test you have to know the answer sometimes. I don't question the text so much, it's in case I don't understand or something I haven't got from lectures and so on.
>
> (P4) ... Yes, sometimes I do, I mean if I don't understand what the writer means, how he thinks, then I do it. Then I try to formulate what I don't know?
>
> (31) ... Things to look up, things that I don't understand. Yeah, if there is anything I don't understand in the chapter. I can write them down and I'll ask the next time we ...

Category E. I do not ask myself any questions

A category E answer means that the student just reads through the material without posing any questions whatsoever.

An excerpt:

> (P10) No, I guess I read and I repeat and I underline and I've been more lazy lately.

In table 9 an overview of the distribution of students over the different categories is provided.

Table 9. Reflections on the approach to reading

	Number of student (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. I ask critical/ analytical questions	5	4	2	5	16
B. I ask myself questions about relevance	8	7	11	1	27
C. I ask myself if there will be any question on this in the examination	1	2	-	2	5
D. I ask other people if I do not understand what I read	-	-	2	3	5
E. I do not ask any questions	1	2	-	4	7
Total	15	15	15	15	60

Students' reflections on the learning

The analysis of the answers to the question: *Do you memorize certain things more than others?* resulted in five categories. In all the answers, students dealt with both the approach to learning and characteristics of the learning tasks. The students either reject memorizing or memorize things that are considered to be of importance in different respects, factual information, something that interests them, information which is going to be in the examination questions, and the knowledge presented in lectures. A combination of the aspects constitute category six. The final category contains answers in which students stated that he or she does not memorize anything at all.

Category A. I want to understand what I read or I memorize the important things

There are two concepts of memorizing in this category. One comprises the answers that reject memorizing and emphasize understanding and comprehension of the knowledge:

> (P33) I don't think I try to memorize things, like this ... learn no, rather I ... no, I can't say, not in specific words, for example ... because it ... instead I want to understand the whole thing more, so to say. I can't learn things by heart, I think that's pointless, ...

The second type of answers, although they do not explicitly reject the usefulness of memorizing, nevertheless emphasize learning issues that are generally not memorised.

There is, however, a variation as to what is considered to be important among the answers in this category.

In the next excerpt, what seems to be significant is the intentional message of the learning task:

> (P23) Yes What I think is important, like conclusions and that I find in the text.

Mechanisms and the causes, the following student says, are important to remember:

> (P25) The mechanism, the why's, why happen? why that happens? That I want rather than examples of a thing.

As we can see in the statement below, understanding of the basic principles in a particular knowledge area is given a high priority:

> (P36) Yes ... Those things that I think are more important. Very basic things ... I think I've got a way of learning which is very much learning basic fundamental things, I'm not very good at learning small details in tiny things. I try to get a ... understanding of the whole thing on a low level rather than ... going very deep into small things. So I think understanding the subject is easier than knowledge in special small things.

Category B. I memorize facts, figures and names

The focal interest in this conception is on detailed factual information. The B conception implies that students memorize facts, i.e. names, figures and symptoms of diseases.

> (P47) No, I don't think so. Well, of course the ... if you're reading about the disease the symptoms for me are important to remember.

Below is an interesting case which might be denoted as pseudo - A. The main reason for categorizing it in B, is that the answer has the form of an A answer but the content of a B answer:

> (P8) When you see important points you try to make a structure one, two, three, four and try to remember each point.

As can be seen in the excerpt above, although the student states that she wants to comprehend what she studies by saying 'I try to make a structure', nevertheless gives an enumeration of things which is not a particularly sophisticated structure. Later on, she refers to remembering words which implies memorizing.

Category C. I memorize what interests me

The emphasis here is placed on the individuals' own interest. The students in this category memorize what they are interested in.

This approach is shown in the following excerpt where the student in general remembers information which interests him or her:

> (P32) Yes, if it's ... something I myself am more interested in, of course, I naturally ... I read it more actively ..., ...

The students might like some subjects more than the others:

> (P5) Oh, yes. I think that during every course, especially the clinical ones there are always some parts that interest me a lot, and some parts are not so very interesting.

or the areas that the students are interested in might have nothing to do with their education at all:

> (P28) Certain things that are funny. They might be without any relevance at all, I just find them funny, so I read them more intensively ... I remember them rather easily because I think they are funny ..., ...

Category D. I memorize things that are important for the exam

In category D, the participants indicate that they memorize what they think could be asked in the examinations.

Below, is an example of this conception where the student says that due to the fact that too much stress is placed on the detailed knowledge in the exams, every student is influenced by the format of the examinations and their requirements:

> (P21) Yes, every student, whatever he says, almost every student is influenced by the tests. How they are formed. How they are structured. And they ask too much about details and not the context and then you learn details and often it's much better to learn details ..., ...

In the next excerpt, the interviewee indicates that if he or she memorizes information, it is for the sake of the examination:

> (P53) No, or ... I do when ... for the examination of course I do and then I try to remember those things that I find difficult, ...

Category E. I memorize what was said in the lectures

The emphasis is placed on what is presented in the lectures.

Assumed to be of great importance, according to the excerpt below, is what was brought up by the teachers:

> (P6) Usually what teachers have said. That I try to memorize more ... All the notes I've made.

F. Combinations of several aspects

In category G, the interviewees express a combination of aspects of the nature of the information to be memorized.

In the following statement, emphasis is laid on the importance of the information for the future (might be the future job or the later phases of the education) as well as examinations:

> (P2) Yes. The things I find important for the future or for the examination.

Ignorant answers

In this category, students say that they do not memorize any information whatsoever.

An example:

> (P20) No, not really, ... No, I wouldn't say I try specifically but I mean one can't help remembering certain things better than something else but I don't actively look for things that I'm going to specifically remember ..., ...

The table below shows the nature of knowledge being memorized by the students.

Table 10. Reflections on the nature of information students memorize

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. I want to understand what I read or I memorize the important things	12	9	4	3	28
B. I memorize facts, figures and names	-	4	-	4	8
C. I memorize what interests me	1	-	2	2	5
D. I memorize what is important for the exam	1	2	3	2	8
E. I memorize what was said in the lectures	1	-	2	1	4
F. Combinations of several aspects	-	-	3	3	6*
Ignorant answers	-	-	1	-	1
Total	15	15	15	15	60

* The combination conceptions consist of:

3 (D+A)	I memorize what is important for the examination in combination with I memorize important things; n=3 GU ten termers
1 (A+E)	I memorize important things in combination with I memorize what was said in the lectures; n=1-GU five termer
1 (C+E)	I memorize what interests me in combination with I memorize what was said in the lectures; n=1-GU five termer
1 (D+A)	I memorize what is important for the examination in combination with I memorize important things; n=1 GU five termer

Reflections on preparing for the examination

Chapter ten ends with a report on the analysis of the answers to the question: *How do you prepare yourself for the examination?*

By asking this question I wanted to illuminate the way in which students work before an examination.

The answers showed that the students talked about different things such as what kind of material they use, how much time they spend learning it, what kind of knowledge they have to learn and, finally, how they learn it.

The answers to this question have not been analyzed in the same way as the other questions. Instead, the answers have been treated in the form of an overview of the different topics students brought to the fore in their comments.

Lecture notes, old examination questions, notes from tutorial sessions (in the case of LiU students), students' own notes or summaries from books as well as text books, according to them, are in general the sources of information when studying for an examination. There is, however, a difference in the extent to which the above-mentioned sources are used or considered as being the most important by the two main groups of students.

The importance of the notes, mainly from different lecture sessions, in the examination are highly emphasized by the GU students.

The importance of reading text books is realized more by the ten termers from both universities. The most pronounced reason is the fact that students want to make sure that they did not miss any important knowledge. It is necessary to mention that even the ten termers read books less while studying for examination.

The frequently use of the old tests when studying is remarkably similar between the two groups of students. Various reasons are given for why the students use previous examination papers. There is, however, a profound difference between the aims of reading old test items expressed by students from GU and LiU in general. For GU students, the aim is more likely to spot the exam system in order to be able to pass the exams *"if I studied everything"* or *"to be able to pass the exam"*.

This, of course, does not necessarily mean that there are no exceptions among GU students in this respect. There were some students who tended to despise reading previous examination questions, preferring to *"know what we should know as a doctor"*.

When it comes to LiU students and their reasons for using old test questions, they are most likely to be concerned about *"to see if we are in the right area"* or *"to know the level of the questions"*.
It must be mentioned here that the point of departure in preparing for the examination for some of the LiU students is looking at the goal of the course to decide what to read.

As for the way in which students prepare themselves for the examination, all groups of students tend to work quite hard. GU students are most

likely to study alone, whereas consultation with classmates is the LiU students' typical study pattern.

Chapter 11

RESULTS: REFLECTIONS ON KNOWLEDGE REQUIREMENTS IN THE EXAMINATION

This part of the study intends to present what kind of knowledge is required in the examinations. In order to do so, students were asked the following question: *What kind of knowledge is required in the examination?*

The analysis of the answers given to this question yielded three categories which are hierarchically different from one another in that they have qualitatively different structural characteristics. The students appeared to be tested either in terms of their understanding of a given area, understanding combined with reproducing facts, or merely reproducing facts.

Category A. The emphasis is on understanding

The core element embodied in this category implies that in the examination the students are expected to express an understanding of the principles involved in a given area of knowledge they were studying during a certain period of time.

The excerpt below is an example where the student indicated that the main interest in the exams is to see whether the students made sense and grasped the meaning of what they had been expected to understand. In addition to the factual knowledge, students' probabilistic reasoning approach to the patients' problems is also valued:

> (P36) A lot of common sense and under ... basic understanding I think ... the way I see it that if you've got some common sense and some ... sense in your head, it's quite easy ... because ... and it's not ... rote learning, that's not what they want us to learn, they want us to have the ... understanding and basic mechanisms and ... also I think this we ... what they ... they emphasize that we have to learn that there isn't a special case like everybody ... all patients aren't square, they can be round, they can be oval and there can be a lot of differences. I think that's the important part. But of course we have to have the ... quite deep knowledge, but ... understanding of deep knowledge is more important than knowing small, small facts.

In the next two comments, students pointed out that the emphasis in the examinations is on understanding the connections and mechanisms to be found in the knowledge area. Even if detailed questions are incorporated in the examination, the student adds, they are there for a better understanding of the content. They are not asked because they in themselves are considered to be important:

> (P33) Yes ... overall knowledge, connections between different things, what can affect what and ... but then, of course, they also ask small, small things ... which are perhaps important in order to understand connections between different things ... sometimes, one may think it ... certain things can be less relevant generally speaking, but on the whole I think that it's more relevant ... large connections between different things.

> (P52) Eh ... often they ask about eh ... big structure ... eh ... to see what we have understood ... if we have understood how ... for example eh ... memory functions ... in what way the ... memory works ... and then you have to know the big structure of the brain ... not the small cells ... the big structure. And then ... they ask me to tell them the answer ... to a question ... like how does memory works ... and then they fill up with smaller specific questions, ... but they often begin with the ... the big structure ... and then they ... they try to shape it into the small ... the small things that is the facts ... the facts about the cells and about the different ... things ... eh ... and so on.

Category B. Examinations contain various types of tasks

The answers in this category indicate that the students' learning is measured in terms of both understanding of principles and mechanisms underlying the phenomena in question as well as retelling detailed facts.

An overwhelming number of the statements noted that examinations differ, depending on what term the students are in, who the teachers responsible for constructing the questions are, what courses they are taking, which department/institution is involved or the type of exams as to whether they are written or oral.

This implies that depending on the above-mentioned variables, students are required to produce different kinds of knowledge in the examinations.

As can be seen in the example below, the student seems to assume that they were given more relevant questions during the clinical period than at the preclinical level of their education:

> (P9) ... In the clinical phase I thought there was a lot of relevance. But in the preclinical one doesn't have any ... one doesn't know what is important and so on. Then you learn a lot, so to say, of things that you yourself might not think were so important; instead, you learn more than what you think is important. But here in the clinical phase I think the questions are good.

Students can be required to know a great deal of theoretical knowledge at the same time as an understanding the objectives in the exams is emphasized. In addition to factual knowledge, skills such as the ability to express ones' own personal interpretation in relation to a given field of knowledge or patient' problems is just as important in the exams. This is expressed in the following excerpt:

> (P39) ... It's very ... varied ... and that's what I feel is so good here, that I like a lot. Ah ... we had to ... to prove that ... that we had a lot of

> theoretical knowledge, but we also had to prove that we could ... make statements on our own ... about things we saw ... or how we thought it would look like and we also had to meet a patient and say ... say what we thought about ... ah ... test results.. and this ability to say something ... in your own words ... I think is very important. Ah ... and that varies a lot, just from, you know, filling in what enzyme is needed or something like that, those are different things.

Another student talks about how exams can be a combination of what he or she considered to be a 'good' and 'not a good' exam:

> (P53) It's different, I think ... when it is a good examination ... the emphasis is on ... understanding. And you have to ... with open questions like ... eh ... tell us about this or ... and you have to show that you really understand what you're talking about. That is ... I think that is the ... the aim ... but they are not always like that. Sometimes there are questions like ... when ... at what ... interval does the ... like chemical or they want a figure like thirty per cent or thirty-eight degrees or such details. I don't like that ... type of question.

Oral exams, the next student says, are preferable since they are more concerned with evaluating students' understanding of a certain phenomenon than written exams:

> (P14) There are different types of examinations, of course, and the practical examination and the oral examination, in my view, is the best examination. Then the understanding of things is tested in a much better way than in the written examination. But the written examination is often of the kind where detailed knowledge is asked for and of course basic mechanisms too. But the broad understanding is not asked for, usually. So detail knowledge, I feel is the most important.

The following lengthy excerpt is another example where the student first divided exams into *'good'*, and *'worse ones'*. The emphasis in the *'good'* exams, according to the comment, is on 'the whole big understanding', whereas the *'worse exams'* measure students' knowledge in terms of irrelevant details. Afterwards, the student went on and pointed to the possible reasons he or she considered to be impediments to constructing the good exams. In addition, the student talked about the oral exams where the students' knowledge may often be inappropriately evaluated. This has happened because some teachers asked students questions with regard to their own domain of research in the oral exams. Oral examination was indeed one of the issues frequently commented on both positively and negatively by several students from both universities. As can be seen in the following quotation, the exams can be improved and, indeed, have been improved over the years this student has been studying medicine:

> (P54) Ah ... eh ... it has been on ... there are some differences between the examinations. - Some of them have been really good ... and then it is ... the good ones are those when it's ... relevant questions ... ah ... of the whole of the big understanding ... so to speak and also with small,

small ... questions, relevant ... to the understanding of the whole. - Yes, and that's a good examination ... and there have been quite a few good ones during ... these ten terms ... and some worse ah ... and what I mean by worse, it's when there are small, small, questions on fields that I don't think are so important ... for my ... ... future ... in medical fields .. and when there're many ... points ... in those small, small, questions so that small questions, for me not so relevant ... ruin the whole test .. then I think it's a bad ... test ... and there have ... have been some of those too ... But on the whole ... it's very different as we have just tests.. every ... examinations every term ... it's very hard to construct an examination that covers ... twenty points ... covers a whole term ... so I ... I also understand that it can be hard to construct a test that covers and that can pick small things to be sure that we know ... but ... it can always be better ... the examination can always be improved ... I think it has got better and better through the years ... because the first ... when I looked at the first tests ... ah ... it was a little bit worse than ... after a while ... the examiners know how to put the right questions and what is relevant and ... normally ... we have this written ... examination and this oral examination ... ... and I think that perhaps the examiners ... ah ... ought to get together and discuss before the examination ... what they want to ask and how they will ... evaluate the ... students' knowledge ... 'cause it can be very ... it ... sometimes it has been ... a great injustice ... between the students, 'cause one student had got an examination that didn't ask almost anything ... and the other one got an examination that asked everything about what he or she was doing in her research field ... in an oral examination, and then if ... ah ... this examination asks the students everything that he or she is doing in his own research field it's very injust ... for the different students,' cause as a student you are not supposed to know everything that the ... examiners are doing in research.. so then it can be ... and there has been a situation ... situations like that and that they can improve ... and that ... by that the examine ... examiners are getting together ...before the examination.. and deciding what is important this term, ... what is ... what can I ask about and how ... what depth, if you understand ... of knowledge ... is ... is important in ... which ... areas ... Now. Yes, every term there have been some ... discussions about the examination and how it could be ... could have been better and how it could have been improved and there are discussions with the examiners ... and with the ... the leading groups, so to speak ... of the medical education ... also ... and if there have been some very injust things ... there have been ... have been big discussions in this group there is also a group of students and teachers in this leading group ... and there have been ... yes ... many discussions ... and some things have ... been improved and some things are still a problem.

Category C. The emphasis is on detailed knowledge

In contrast to category A, this conception showed that high priority in the exams is given to seeing whether the students had remembered facts they were taught during a specific period of time.

It is necessary to mention here that students who said that old test questions are used in examinations are also found in this category. It seemed reasonable to do so, because there is no way of knowing whether students understood what they were supposed to know or whether they just memo-

rized the answers to those particular questions, given that sometimes, as we can see later in the excerpt expressed by (P15), an entire old test was used or as (P13) states, most of the exams have followed the same pattern.

The prime emphasis in the exams is placed on details as is illustrated in the following answer, due probably to the fact that these kinds of examinations are easy to mark:

> (P6) It's often very detailed and also here it's ... The problem is that it's very detailed they don't check what you have understood much. but incidence of diseases and much ...Yes, all the numbers they can find in the books. I think it's quite easy to correct these kinds of examinations so I get the feeling that's the reason why they keep those questions.

Another example of this conception of exams is the following student who said that the major emphasis in the exams is on the content of the lectures and the assessment of the answers is based on the extent to which the precise wording of the lecture notes are remembered. This student furthermore added that students' personal interpretations of the learning material is not rewarded:

> (P26) It's very much, ... what do you call it ... point form. for example. And maybe there are twenty different things that you said they have said on the lecture. So I think sometimes there is too much retelling everything the lecturer said instead of your own thinking, you can't make your own thinking into words. Do you know what I mean You can't draw your own conclusions and continue your own reasoning and arrive at your own conclusions, you can't do that - instead you have to rattle off the points said by the lecturer ...

This heavy emphasis on the lecture notes caused frustration for the next student who, contrary to his or her wish, had to learn 'little things that they want me to remember' in order to pass the exams:

> (P29) ... usually most of the questions relate back to the things that they have told us during the lectures. And sometimes that's frustrating because I want a more overall picture and I know that if I want to read the book, then my time will not be enough to really learn things. I will have a basic understanding and a pass of knowledge. But I will not have the ... all the little things that they want me to remember. So to be sure to pass the test I would say, you should just read the ... your notes. But I find that more likely you learn it and you forget it. If you want to remember something, you need to read the book to get a basic understanding.

Below, is an example where the student is very unhappy with the fact that the old exams are frequently used during the course of the education program. According to this quotation, students had an examination where old examination questions were used again. Examination of this type, the student adds, would not enable teachers to judge whether students had really understood the central content of their field of study or had only learned

the answers to particular questions. On the other hand, the participant says, if the students had not seen the old questions they could not possibly have passed the examination. The use of this kind of exam, this student pointed out, is more frequent during clinical than pre- clinical studies:

> (P15) ..., I think I'm not at all content here because we just finished the course here about ? But they were not asking for, they didn't know if we knew what we should know. Because they were giving us an old examination test that we had seen before and I mean they can't do like that. It was almost ..., the whole test was old questions and I know in ...? they do that in quite a lot of courses, and that's so very, very bad, because they don't know if we really know it. Or if we have only been reading up on old tests and that's so stupid, and everyone knows it but one knows if one hasn't seen those old tests, then it's almost impossible to manage, to pass through it. So in ? it's so catastrophically bad because they don't check if you really know it. That's not so in most of the preclinical courses but here on the clinical courses they are just so very old-minded so to say, and very, very conservative and they use old examinations. Yes, often, too often.

Next, is another instance of having this kind of conception about examinations where the student mentions that he or she was able to answer several questions with regard to a given phenomenon while he or she had no understanding whatsoever concerning the issue:

> (P13) Very basic. I remember for example the chemistry examination then it was something called the ? I don't remember exactly what is was, but it was some field of research where we had to ... which they talked a lot about and you had to know a lot about it. But it was only things that you could learn by heart, I never understood what the ? really was but I could answer ten questions about it. Like how it was regulated etc., etc., but I never understood what it was all about. But that was never tested in the examination.

In answering the question as to why the student did not try to find out what the real description or explanation was, the student said that he or she did not do that because his or her major intention then was to 'fit into the form':

> (P13) That was at a time when I was already disillusioned so I was happy to be able to fill in the form.

The distribution of conceptions of the knowledge required in the examination is shown in table 11.

Table 11. Reflections on the kind of knowledge demanded in the examinations

	Number of the students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. The emphasis is on understanding	5	8	-	-	13
B. Examinations contain various types of tasks	10	6	7	11	34
C. The emphasis is on detailed knowledge	-	1	8	4	13
Total	15	15	15	15	60

As can be seen in the table above there are no GU students among the 13 participants in category A where understanding of the learning materials is exclusively emphasized. Category C is similar for LiU students where only one student from LiU term 10 is among the 13 students in this category. Category B, *"Examination contains various types of tasks"* comprises 34 participants and is by far the largest group.

It should be mentioned that LiU students more often encounter examinations in which the chief concern to measure students' understanding whereas, according to the GU students, examinations mainly require a restatement of what was presented in the lectures. This latter aspect was also brought out by some LiU students.

GU students are more likely to favour oral exams where they are given the opportunity to be evaluated in terms of their understanding of the knowledge, whereas LiU students seem to be more critical of this type of exam due to the fact that teachers' interest in their own research area could determine the content of the examination questions rather than the stated goals of the course.

The use of old examination questions is another concern of the students. GU students appear to have more often experienced this kind of exam than LiU students. In other words, the kinds of demands placed on the GU students in the exams seems to be all too often less than ideal knowledge for medical students.

Chapter 12

RESULTS: META-CATEGORIES OF CONCEPTIONS OF KNOWLEDGE LEARNED BEYOND THE STATED CURRICULAR AIMS

The main question in this domain was formulated as follows: *What is the most important thing you have learned during your medical studies so far?*

The aim of this question is to look beyond the formally stated educational goals, to attempt to find out what, if any, additional educational achievements students think they have obtained. In other words, we were interested in seeing whether there were any effects on the meta-level of the education and, if so, what they were like.

Five main categories have emerged in the course of treating the interview material. In the analysis, almost all the answers regarding the most significant knowledge learned can be placed in any of the categories which, by their nature, are value statements.

Category A. I have learned that knowledge is lacking or only provisional

The emphasis in the A conception is on the nature of knowledge. These answers imply that the years of education in general have provided students with the opportunity to evolve their way of thinking with respect to their knowledge perspective.

One way can be shown in the statement below where the student reaches a form of understanding about the relativistic nature of scientific knowledge:

> (P48) I think there is no absolute truth. That it's a difficult area, that you must be very humble, ... very careful. Because ... it's not ... it's not ... And it's not as easy as people think, heheh! I think that's the most important thing, that there's no an absolute truth

It may also imply the discovery that medical knowledge has its limits, and so does the doctors' own knowledge with regard to the treatment of patients' problems:

> (P17) That is that the medical science doesn't have the answer to everything. That the doctor doesn't know everything, there is so much that is based on experience and there are so many things that they don't know anything about.

Another fact realized by the students is that the amount of medical knowledge is increasing enormously and one has to keep up with the develop-

ments if one is to be effective in one's work as a doctor, let alone being a perfect doctor who is able to provide alleviation for all the existing ailments one hoped for. This is evident in the following excerpt:

> (P34) That I'll never have learned everything. That I will never know everything, never, ... that I have learnt. I can never be perfect. That's important ... cause ... before I was thinking that ... if I read about this disease, I could know everything about the disease, but I was wrong, it wasn't so easy, ... it's just that ... I will never have learned everything, I will never know everything, I will never ... you shouldn't believe that you can ... that you have the truth ... the whole truth ... you never have the whole truth.

Being careful and seeing things from different angles and from different perspectives is another realization expressed in the quotation below:

> (P14) One most important thing is never to be sure of what you think you are sure of. There are always people more experienced than yourself who you should consult even if you are sure.

Category B. I have learned to communicate and co-operate with other people in a respectful way

The importance of the B answers is attached to 'other people'. This category comprises answers in which students state that the most important thing they learned during their university education is, generally speaking, how to deal with people.

One has to be respectful towards the patient and very careful in making one's mind up when confronting with people, as P11 puts it:

> (P11) I think perhaps to respect people and to listen to them and not to decide what to think quite as fast as I did before.

To be 'humane' when encountering people is the most important realization for the next student:

> (P36) That eh ... everybody is a human being with a little soul inside them I think. To never forget about people's ... feelings ... people's feeling ... and that ... that part is very important too, I think. That's the most important thing I learned ... or realized.

Having worked with people in *'the tutorial group'* develops one's communicative ability, as we can see in the following quotation:

> (P42) Ah ... it's about people ... that's the most important thing. I think ... ah ... just ... just through the actual studies ... that's ... ah ... ah ... well ... because ... because studying here means that you ... do interact with a lot of people ... ah ... that you ... you're forced to ... ah ... you're forced to be with people, a lot of ... of ... of different people all the time, right ... and ... and ... well, that is very ... that is very developing I think. So ... ah ... ah ... that is I think what has changed me most. Yeah ... of course the being with people ... here but in ... in this ... in

> this special way, I think, that university studies ... mean and perhaps even more with us because we work in a group all the time.

While P42 was general in his/her comment, the following excerpt shows that working with people in *'the tutorial group'* makes one knowledgeable about people's attitudes and behaviour. This awareness in turn helps one to develop a proper ability to work with them:

> (P43) I don't know, I guess I've learned about how people think, how people react. I've learnt to work with people ... even the ... the ... I can work with people even though I don't ... I don't have to like them ... but I can work with them. In these groups ... if it does work, I can be angry with someone and then we go out from the ... from that meeting and ... we're friends ... I guess that's what I've learnt. You don't have to like everybody but you should be able to work together ... and you can work together.

Below, is an example where the student is very happy about the fact that he has obtained skills which will enable him to achieve a better relationship with patients:

> (P52) Oh ... most important ... I think ... for me the most important thing I've learned ... is eh.. that I have got away to evaluate myself or develop myself in ... when it comes to ... meeting people in the clinical situation ... that is ... as I said before talking to people in different situations ... trying to meet them, and I think I've an instrument to work with myself to improve that, or at least ... eh ... have some self-criticism ... that way. That's what's most important for me.

Category C. I have learned to value life

This category includes answers in which participants, in one way or another, developed in their moral judgements. They can either be more respectful towards life:

> (P39) That's a difficult question ... eh ... that life is so diverse, I would say. Yes, that I have ... to respect ... so many more things than I can even think of. To respect life. That I find very important.

or look on life from a kind of super-existential perspective, where one should appreciate the present moment:

> (P50) The most important thing ... that life is now. There is no future. Life is now and now and now and now. There is no future.

Below, is another example in which the student simply says that he/she has learned the meaning of life and death:

> (P9) One has learned more what life and death are, I think ...

Category D. I have learned to take care of myself and/or others

In this category, the most significant thing seems to be to learn how to take care of either oneself, as is illustrated in the following excerpt:

> (P27) Taking care of myself. Learning that I know how to take care of myself.

or, as is shown in the next comment, where the participant not only mentions that he or she has learned to take care of him or herself but also his/her relatives and other people as well. In addition, this student clearly refers to the means which enabled him or her to do so:

> (P51) I have learnt to take care of myself, and my family and other people. I care about other people ... others more now, I think, I have learnt things like tools ... to make my ... other human beings have a good life, do you know what I mean? I've learnt these tools and ... and that's a .. that's a gift ... that was philosophical ... I can't ... I can't ... be more precise ... I can't point to anything special ... more than just this ... I can't point to ... last week I learnt how the heart works ... but On the whole what I have learnt during ... five years ... studying, is now that I have tools ... to make other people ... having a better life or ... Not to cure, just to make them ... a little bit relief ... And ... like I said that ... take care of myself and my family ...

Category E. I have learned self-esteem

Students whose answers belong to this category emphasize that they personally developed and acquired a kind of self-knowledge during their medical education:

> (P23) It is that I as a person, I'm able to learn a lot. I'm not worse than anyone else. And everything I've tried I've managed. And I've got a lot of self-confidence from that actually. Because we have gone through a few things that maybe I wouldn't think of before. But when there is a task I know that I can do it. And of course I couldn't go out and work as a doctor today but when that day comes I think I will be able to stand there in the ward.

Below, are two excerpts where the students realized the importance of determination in achieving one's goal:

> (P31) That I can if I want. I can do what I ... if I ... as long as I want to ... I have the possibility.

> (P55) I have also learnt that it ... isn't so difficult, or you can make it, you can be a doctor if you want to, you don't have to think this is so very difficult, because everyone ... if you want to and if you are quite normal so ... you can make it. there's nothing special about it.

Having achieved confidence in one's ability as well as learning what one may or may not be able to accomplish are the significant facts learned by the student, as shown in the next example:

> (P56) The one most important. Some things that I have learnt that is ... and they are very important is ... one to have confidence in myself ... and with that confidence also goes the ability to show that I am wrong ... or that I ... my knowledge have limits. I can't ... I can't do ... everything ... and if I know that I has limits, then it's ... it's not difficult to ... to show other ... it might be patients, it might be colleagues or it might be friends ... but if I know my limits and also have confidence ... in myself within those limits then every personal encounter ... will be a benefit.

Category F. Combinations of conceptions

The answers in this category comprise a combination of conceptions described in the previous categories. In the quotation below, the student gave an answer which consists of both (A) and (B):

> (P54) Maybe ... it's a little bit that ... ah ... there are so many different persons with different experiences and you never know when you meet them what they have been going through before and you never know what experiences they have and why they are coming to you. As a doctor. And ... also maybe ... that there are no often no black and white ... that there are ... ah ... ah ... in ethical ... things I mean ... in ethical questions ... then it's hard to say ... this is right and this is wrong and you must be ... you must be humble in a way ...

G. Residual category

Answers in this category have particular characteristics; that is, although they are describable, they nevertheless cannot be exemplified in the categories described before. An example:

> (P20) The most important thing is that everything comes through the brain, you can control the brain and you in that the brain is the, ... I mean they base life on brain death now, so I mean I think that's the most important thing.

H. Ignorant answers

In these answers, the interviewees say that they cannot point to anything as being the most significant knowledge they have learned:

> (P28) I don't really know. I think it is a hard question. I can't really differentiate those things.

Table 12 illustrates how conceptions of knowledge is distributed over the interviewees.

Table 12. The knowledge attained beyond the stated curricular purposes

	Number of students (n=60)				
Category	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. I have learned that knowledge is lackingor only provisional	4	5	4	5	18
B. I have learned to communicate and co-operate with other people in a respectful way	7	1	1	7	16
C. I have learned to value life	1	1	-	1	3
D. I have learned to take care of myself and/or others	-	1	4	-	5
E. I have learned self-esteem	1	1	-	-	2
F. Combinations of conceptions	-	2	1	-	3*
G. Residual category	2	2	4	1	9
H. Ignorant answers	-	2	1	1	4
Total	15	15	15	15	60

*The different combinations of conceptions consist of:

1 (A+E)	I have learned that knowledge is lacking or only provisional in combination with I have learned self-esteem; n=1-GU five termer
1 (A+B)	I have learned that knowledge is lacking or only provisional in combination with to communicate and co-operate with other people in a respectful way; n=1LiU ten termer
1 (A+E)	I have learned that knowledge is lacking or only provisional in combination with I have learned self-esteem; n=1-LiU ten termer

Category A with 18 students is the largest category followed by the B category with 16 students. In both categories, the answers are equally distributed over the students from both universities. These two categories, however, differ from each other. In contrast to category A, where there are very small inter/intra group differences the intra group differences in B category are substantial.

Chapter 13

RESULTS: REFLECTIONS ON THE EXPERIENCES OF MEDICAL EDUCATION

In the five last chapters, the results of the outcome of learning, the way students approached their learning material used in this study and in general, reflections on the knowledge requirements in the examination as well as meta-categorization of knowledge were presented. They provided us with some pictures of the above-mentioned issues. This chapter deals with the students' experiences of medical education. To obtain the students' view, they were given a set of different retrospective open-ended questions such as; *How do you experience your studies at the university? How do you experience the faculty of medicine?* Also dealt with is how far they thought their expectations had been met during these years of studying: *Is medical education more or less as you expected?*

The data were collected by the use of several questions posed to the students. This method provided us with valuable empirical data in that what is underscored here is what students thought was of major significance. They are not a set of areas selected in advance by the researcher which requires students to comment upon or asks students about either agreement or disagreement.

Up to this point, the results of the analysis have been reported in a way in which answers to each individual question were analyzed and the result was reported separately. In other words, the answers were treated systematically per question. Furthermore, the inter/intra group differences between students were presented by means of tables and comments when needed.

As in the case of the questions about students' experiences of the university as well as the faculty, the answers to the respective questions seemed to have been very similar which may indicate their validity.

In a few cases, the answers are almost identical, for example, after having answered the first question the student's response to the second one was: *"Mostly as I said ..."*, or *"My experience of the university is my experience of the faculty of ... I don't think there is anything more to add."* Or if the first answer was: *"good. I don't know what to say more."*, the answer to the second question was: *"I'm satisfied but I've got nothing to compare with. So that is hard to say."*

In other answers, the statements were complementary to each other, that is, if, for example, one student gave statement of the following nature: *"Sometimes I enjoy studying medicine and sometimes the courses are not that good. ..."* to the first question, in the second answer he or she was more specific about what it is that he or she meant by saying that 'some courses

are not that good' in the following way: *"Not always too good. People are not interested in us students. ..."*

This is the reason why the answers given to the first pair of the three questions mentioned above were analyzed together. Firstly, due to the fact that they contain a similar substance and secondly, in order to be more convenient for the reader and for the results of the analysis to be more interesting.

What is to be presented in this chapter is firstly, an analysis of the answers given to the first pair of questions concerning how the students experienced their university studies and secondly the answers to the third question.

After reading the comments repeatedly, an overall impression of the answers was that they were assessing the university education. It can be seen in almost all of the interviews (except for the seven unspecified answers) that the students' answers contained two kinds of properties; a) the attitudinal component; the students' way of assessing the university education and b) the students' focal point of interest when it comes to their experiences of the university education. Seven answers from GU participants were only value loaded and did not deal with any specific aspects of the education whatsoever. They are named unspecified.

Taken into consideration the above-mentioned characteristics of the interviews, answers were analyzed in the following way. Firstly, they were categorized based on the 'theme' which was the major point of focus in the students' comments and secondly on the participants' assessment of their entire university experience.

What follows is first a description of the issues brought out in the interviews followed by the students' feelings about their university studies.

Aspects of the curriculum dealt with by the students as well as their direction of the attitudes toward these aspects

A compilation of what was brought up by the students in the interviews as well as how students felt about the studies is presented in table (13). Thereafter, a description of the issues commented upon by the students is reported under separate topics. Under each topic, a detailed description of the students' perceptions of their university experiences is provided which reflects views delineated in their statements. Verbatim quotations have been selected from the interviews in order to more clearly define the aspects as perceived by the participants. The selection of the quotations followed the criterion that they should encompass the nature as well as the range of the concerns dealt with by the students.

In the interviews, the students did not deal with medical education as a whole but different aspects were selected and brought into focus.
In the two main groups of students participating in this study, there is quite a striking difference in the direction of attitude towards the various issues

brought up as well as the spread of the type of the aspects concentrated upon.

Table 13 shows the issues which were perceived to be prominent by the students, the direction of their attitude toward them, as well as the distribution of the aspects over the students.

Table 13. Students' attitudes and type of aspects

Number of students (n=60)

Aspects	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Teaching-learning	10 pos.	5 pos. 2 pos./neg. 1 neg.	1 pos. 1 pos./neg. 4 neg.	- 4 neg.	28
B. Continuity between different parts of education	- 2 neg.	- -	- 1 neg.	- 2 neg.	5
C. Teachers' attitudes	- -	- -	- -	2 pos./neg. -	2
D. Clinical education	- -	- 1 neg.	- -	- -	1
E. Personal	- -	1 pos. -	1 neg. -	1 pos. -	3
F. Work load- time constraints	- 2 neg.	- -	1 pos.. 1 neg.	- -	4
G. A combinations of aspects	1 pos. -	4 pos./neg. 1 neg.	- -	- 4 neg.	10*
H. Unspecified answers	- -	- -	4 pos. 1 neg.	1. pos. 1 neg.	7
Total	15	15	15	15	60

Key:
LiU = Linköping University
GU = Gothenburg University
pos. = positive
neg. = negative
pos./neg. = partly positive

As shown in table 13, teaching-learning aspects were of major interest to all groups of students. For the LiU students, when there was any comment

in this respect, it was mostly of an appreciative nature, while students from GU were most likely to have unsatisfactory feelings about these issues.

Only seven participants from GU were not specific in their answers in that they merely expressed their feeling about their university studies and did not bring up any particular topics in their comments. In other words, these answers only contained the students' attitudes toward university studies. Of these seven participants two students, equally distributed over five and ten termers, had negative experiences. From the five positive answers, four belonged to students from term five and one was from ten termers.

*The different combinations of aspects consist of:

4 (A+C) neg.	Teaching-learning in combination with teachers' attitudes aspect; n=4-GU ten termer
1 (A+C) pos.	Teaching-learning in combination with teachers' attitudes aspect; n= 1-LiU five termer
1 (A)pos. + (B) neg.	Teaching-learning in combination with Continuity between different parts of education; n=1-LiU ten termer
1 (A) pos. + (F) neg.	Teaching-learning in combination with Work load- Time constraint aspects; n=1-LiU ten termer
1 (D+F) neg.	Clinical education in combination with Work load- Time constraint aspects; n=1-LiU ten termer
1 (A) pos. + (D) neg. (C) neg	Teaching-learning in combination with clinical education and teachers' attitudes aspect; n=1-LiU ten termer
1 (D) neg. + (E) pos. + (F) neg.	Clinical education in combination with personal and Work load-Time constrain aspects; n=1-LiU ten termer

Aspect A. Teaching-Learning

The way students learn and are being taught is the most dominating and common theme in the students' comments from both GU and LiU. There is, however, quite a marked difference between the way these two groups of students feel about these aspects of the curriculum. What emerges from the whole interviews shows clearly that while these two issues are considered to be a source of satisfaction for some students (LiU students) they are perceived to be a serious source of problems for others (GU students). The latter group appears to have been required to learn factual detailed knowledge mainly presented to them in lectures. The kind of instruction they get, they complain, does not allow them to learn in a more meaningful way. Another matter of concern is lack of self-directedness in students' different study activities.

An overwhelming number of answers commented on teaching-learning aspects. To make it easier for the readers to follow the nature of what was said in this regard, I decided to present separately comments given by each university students group. In the following, first the GU students' com-

ments in this respect are presented. Thereafter, the answers given by the students from LiU, concerning the issue at hand are described.

GU students' comments

In the following quotation, the student tends to place a heavy linguistic emphasis on the teaching-learning matter which he or she considers as deficient in his or her education:

> (P25) ... And I'm fed up with lectures and studying notes from lectures ... My study technique has become worse. You become more tactical, you don't think that you should learn for life. Instead, you think that it is for the time being, for now. To learn as much as possible and then as I said I don't think the studies are very intellectual. We are not forced to think ourselves when we study articles for example. And since we are presented with so much, we get used to just getting it, chewed and in small boxes. So that's what I think about the studies, the university studies.

The above excerpt shows a feeling of contempt for the university education obviously due to the fact that the lecture format is the predominating method of instruction which according to this participant, fosters passive learning of fragmented facts and provides little room for acquisition of knowledge by self-discovery and self-study. It can also be seen that, although P25 is very critical of and unhappy with the way they learn, she nevertheless had to give up what she thought was the proper way of learning and kept very much to what was required by the educational system she is part of. Consequently, some good qualities as regards 'learning skill' are suppressed as a result of being a passive recipient of information during university studies.

> (P9) Very much learning facts, may be not much of an understanding, just very much facts. So there is a risk that one can forget the whole thing. But on the other hand facts are also important. Integration of knowledge is the student's responsibility. We are served such a lot. We are not allowed to think ourselves. So we are provided with lots of details and there is a risk that one gets confused or lost in details and forgets about the 'whole'.

As we can see, the above student is very much concerned that there is too much emphasis on facts without learning the principles of handling and organizing them in a more holistic and meaningful way.

> (P17) .... I think there is so much time we have to be in school, there are a lot of lectures. In the beginning I thought that was good, they told us what to learn and when I think it doesn't feel so very academic to get a notebook and just read a notebook and so far in this education until now, I am sure of that anyone could pass until here without having read a single book. If I would want to read a book, that takes a lot of time and you don't have that time always. You could read a book out of interest but you don't have the time to read a book and use it as study material. Your own notes are more important.

> (P23) ..., you know that we usually get everything, almost everything from lectures. And the exams ... they do emphasize what is said in the lectures. So because of that you're forced to go to lectures and read your notes very carefully and there is not very much time for self-study. ...

It is evident from the above last two quotations that heavy reliance on lectures and too much emphasis on what is presented in them in the examination keeps students away from books and articles on the one hand and, on the other, hinders fostering independent learning skills and a questioning attitude in the students. One interesting issue which emerges in all the excerpts containing complaints about the teaching-learning side of university life is the fact that students, although very much concerned, could very well manage to ignore, for the time being, whatever they feel about these aspects of their education and successfully live up to the expectations conveyed by teaching and assessment method.

Although implicitly, sometimes students by being critical of university studies, put the kind of education they received at upper secondary school, into question:

> (P18) ..., ... The first years deal very much with theoretical knowledge. It is difficult to see any connection with clinical contexts and often it is difficult to motivate oneself to study. It is like just a continuation of upper secondary school. Very much 'telephone catalogue' reading as I saw it. Sometimes completely absurd.

> (P19) I think it was very nice to study here. It has been like a dream for me since I was little, so it felt nice. Compared with upper secondary school where we did so many things that we did not actually like doing, here we have the possibility to read what we like. That is very nice ....

Actually, several students from both universities, when expressing either their content or discontent with university studies, compared them to their upper secondary school education saying that 'it is a continuation of upper secondary school' or 'it is not like upper secondary school'. In other words, either way, high school education is obviously not appreciated by some students due to the fact that it basically encourages learning not understanding.

Some students from GU- term five, although acknowledging the fact that there is a need for basic changes in the teaching-learning system, nevertheless, were not pleased with the changes brought about, by a so-called *'90's strategy'*. What they appear to be complaining about, was the *'extent'* which it covers the part of the curriculum as expressed in the two following comments:

> (P17) .... Sometimes they have taken away from the schedule certain lectures and told us to study that in a book or any other material that is given to us, so we know what to study and what material to use. I think the intention is good but as there are lectures in all the other

> subjects and then just a little part of this for self-study, and they just tell you, you have one day or two days, read this now. So there is not so very much freedom to plan your time then.

> (P27) Quite conservative. Willing to take more modern things into the studies and university. But you see, in my course we have been the first in what they kind of call, *'Strategy -90'* And that is a new thing to make us to read more literature and not to go much to lectures, take notes and go home and read them. But for us as it hasn't worked very well, it has taken a lot of time that wouldn't have been necessary and I hope that they have managed to arrange it in a better way.

or the *'timing'* of the reform:

> (P23) There has to be more time for self-studies. This ...well, of course ..., maybe you know that we usually get everything, almost everything from lectures. And the exams and different ... and everything they emphasize what is said in the lectures. So because of that you're forced to go to lectures and read your notes very carefully and there is not very much time for self-study. But of course it is changing and they have realized that they can't go on like this. ..., ... So I think changes have to be made. But they have to be there at once when you start the first term, so you realize that now I am at university doing university studies and I have to think in a different way. ...

Totally 10 students from both term five and term ten talked about these two aspects, of which more students had negative experiences.

LiU students' comments

The nature of the comments given by GU students and how they felt about teaching-learning issues have been presented earlier. What will be described now is what LiU students said in this respect.

In contrast to the above excerpts which, showed how some students were critical of and unhappy about the teaching-learning issues the following comments reveal how some other students are satisfied.

Below, is a quotation where a student agrees with the way they learn because it creates motivation in the students to learn. The incentive which initiates learning, the student says, is the individual need for knowledge, not success in the examination:

> (P59) ..., but here the process of learning is ... is more ... it's more motivating and I think the tests here ... don't matter so much to me. Eh ... because I ... I'm not learning for a test, but for myself ...

Having freedom of action in one's learning activities is appreciated by P34. The fact that this student is given the responsibility for managing his studies, according to the excerpt, gives him a sense of maturity:

> (P34) ... I couldn't study in a different way, no. And this freedom I like it so much because it ... it makes me feel that I ... I'm a grown up

> human and can take a responsibility for my own studies and for my own future work and responsibility for the patients.

In the next statement, the student expressed his or her discontent with the university education due to the fact that what is promised by people responsible for the education is not always delivered. On the other hand, the student is satisfied with the opportunity of working in groups. According to this student, working in group contributes both to the personal development of the student as well as promoting his/her study skills:

> (P39) ... ... I'm pleased about being here, I like it a lot. But also there are a lot of things which I don't like. .... I came to Linköping, because I thought they would be so good, and they also ... they make them sound ... so good, but they don't function in that way in reality, because I found the responsibility is ... eh ... not always held like it should have been. A lot of things just ... like ... they just tell you should do specific things ... and perhaps they promise you that you'll get support, perhaps materials or persons who know about this who'll help you and so ... and that doesn't happen and you're still supposed to know about it or something like that ... and I don't think that's fair, especially not if they tell you from the beginning, that wow ... this university is so good because we have this and this and this and then that doesn't happen. That makes me mad. I think the best thing about ... at the university here, is that you ... ah ... get the possibility to and you have to participate in a group and you have to work together. This I find very stimulating for me myself ... both for my ways of studying and also for my personality, to develop ... and ... that's very nice.

Below, is another example where the student felt that learning is more meaningful because it is directed towards an understanding of *'the most important thing'* as well as an understanding of *'the connections between things'*. Learning is also considered to be *'more fun'* due to the possibility of having discussions with fellow students:

> (P33) Ah ... well ... I think it is interesting, funny, I like the way we study ... It is meaningful ... ... it is not just ... a ... try to understand the most important things and understand the connections between ... different things ... and I think it is good that we have ... group meetings that one can discuss with the group, things that one thinks are important. So I think it is very much ... I think it is more enjoyable and more meaningful than the traditional way of learning.

One student was unhappy with the fact that some disciplines receive an insufficient amount of time:

> (P50) ... it's ... eh ... the big part of it, I like. But we're still at the beginning of a new education program and ... there're a lot of *'child diseases'*. A lot of ... institutions want to have ... eh ... greater parts in the education ... and there ... there is not enough educational time, or what do you say? We only have five and a half years. - And ... the ones who scream the loudest they get the biggest places in the education ... and ... sometimes you can see it's a ... wrong division. For example microbiology ... they didn't scream loud enough so they didn't get that much space. But for example ... primary care ... screamed loud and

> they got a lot of space. So I don't think it's really a balance. Now ... I hope there will be in the future, a better balance.

Eighteen students from LiU brought the learning- teaching aspects into focus in their statements. The tone in almost all their comments is generally favourable

Aspect B. Continuity between different parts of the education

Integration between different parts of the education program appears to be another subject of discussion in the interviews. Some students seemed to assume that they learn different parts of their medical education without being able to see any relation whatsoever between them.

Teaching hours could become a waste of time due to the lack of proper co-operation between the members of one and the same faculty, as one student from GU-ten termers stated:

> (P11) ... it's divided into a large number of faculties and they don't have very much contact in between each other I think, it is often the case, that the teachers or the doctors or the teaching doctors at one faculty don't know what you've learned in previous courses and they teach you too much of what you already know or sometimes too little of what you don't know because they think you've learned it.

An excerpt from one of the LiU-five termers:

> (P41) ..., I ... so no one sees ... no one has ... the ... overview ... over ... our situation or no one knows what we ... what we know and what we ... haven't learned yet ... so ... Yeah, the ... the teachers ... sometimes ... sometimes they ... they start on a too high level for us, and sometimes they don't know that we ... well sometimes they start too low. So they seem ... it seems like they ... they hasn't got ... any idea of where we are ... standing ....

Below is an statement from one of GU-ten termers indicating that, based on the lack of proper co-operation between different departments and particularly preclinical and clinical stages, students could not benefit from their preclinic period the way they could otherwise have done:

> (P6) ... I think there is rather bad co-operation between the preclinical and clinical education. One could benefit more from preclinical studies if one knew little more about the clinic, I think. It is a bit like a grey blanket and what was important to learn. Yes, had one known what one knows now, one would have studied in a different way, I think.

Aspect C. Teachers' attitudes

Teachers' attitudes and behaviour towards students was an other theme more negatively talked about by the students. Expressing dissatisfaction with this issue is particularly common when assessing the clinical period of the education program where the students confront uninterested teachers:

> (P8) ... It's very different in different places you go to, but generally you have a feeling that they are not most interested in teaching, they are more interested in doing research so they feel like teaching is more like a special task for them,

> (P2) ..., ... Old doctors have forgotten how it was to be a student themselves. They are arrogant. I thought it was rather boring the first two and a half years in the preclinical studies. And I always look forward to doing the clinical part. Some clinical doctors are just fantastic and that's what brightens our minds. That's the important thing for us students, to be able ... So there are some persons who are very uninterested in us and some are really good, remembering how it was being in this situation themselves. Trying to teach us as much as possible.

This aspect was focused on in combination with other aspects by several students.

Aspect D. Clinical education

Clinical education is another topic which is brought to the fore by the students. Next is an excerpt given by a LiU-ten termer who criticized this part of the education program in the following way:

> (P48) ... the part of it I like is the contact with the patients ... that part ... I think with the guidance we have ... in the clinics ... is very bad. That we're left ... alone. That we very much have to grab the doctor and say 'Please' hahaha! Teach me this!! So ... something ... you feel very left alone sometimes and ... that's something that makes you feel bad too. That these are real ... real persons and so ... soon you'll have to do these things more, like practical things, alone and ... that we don't get the guidance we need.

It is clear from the above statement that the inadequacy of clinical training as regards both the quality of the content of the education and the teachers' attitude when encountering the trainees was of significant concern to the student.

It is worth mentioning that clinical education was commented on by several students in combination with other aspects of the education program. We return to this issue both when describing the 'Combination of aspects', and later on.

Aspect E. Personal aspect

This issue is also discussed by some students in the interviews. Below is an example from GU-ten termers where the student expressed his or her personal satisfaction with the university education:

> (P12) I have never been in any other faculty but I've liked it. We have heard a lot of reports from other places and I think this way of studying suits me pretty well. You get served a lot of facts and just have to read the facts. ..., I suppose it's what type of person you are.

Below is a LiU-ten termer who thinks PBL is not for him or her:

> (P57) Eh ... It doesn't suit me really, I think. I would rather go to ... eh the other ... universities in Sweden. I think it would be better. I need more strict rules to get through the ... the studies, because I ... well, I find it hard to ... by myself looking for all the answers. I want someone to tell me the answers ... more.

Aspect F. Work overload and time constraints

From the comments made by the participants, this theme takes on a number of different forms when discussed by students in different groups. When GU students talked about these two issues their comments had the following nature; *"a lot of hard work"* or *"it takes a lot of time, you don't have time to do other things"*.

When LiU students commented on these two aspects, the judgement sometimes changed its nature. In addition to general expressions such as; *"it is hard"*, *"heavy"*, *"lot to learn"*, some other values emerged in the comments.

Below is an excerpt where the student is critical of the size of the work load caused by trying to acquire appropriate learning skills to be able to deal with study materials effectively. An excerpt from one LiU-five termer:

> (P42) Mm ... but I do think that it does require a bit more energy here ... to find out, especially if you're not confident about the way ... that you study ... it does take quite a lot of energy too ... to get into it. If you're not studying properly then you have to do much more, ...

As is obvious in the next quotation, a considerable amount of effort was required on the part of the student to deal with the amount of information to be studied in the early stage of their education. Another excerpt from one of LiU-five termers:

> (P38) ... Like a little bit of adventure ... in the beginning the first term was extremely frustrating. I thought there was so much to learn and I didn't understand half of it.

Next is an excerpt from a GU- five termer where he or she expresses his or her points of view on this issue:

> (P21) Not as tough as I thought or from the beginning or what I'd heard before. Thoughts like you have to sit all day, it's a job with no end.

These aspects were brought up by several other students in combination with other aspects.

Aspect G. A combinations of aspects

The answers which are categorized under this label deal with more than one aspect of the medical education. As can be seen in table 13, the students talked mainly about teaching-learning aspect of the education combined either with the teachers' attitudes, clinical education, continuity between different parts of the program or work load-time constraints aspects.

The fact that most of the teachers are primarily engaged in and interested in doing research and not in teaching is one of the major problems for the students from both universities. Teachers' lack of time, interest, responsibility as well as respect towards students, according to both groups are considered to be impediments in the teaching-learning process, particularly at the clinical stage.

Below are some excerpts from LiU ten termers in which they express their dissatisfaction with clinical education with regard to teachers' attitudes and their satisfaction with the teaching-learning issues:

> (P46) Hm, that's a big question. Ah ... I find it interesting, it's fun, eh ... I sometimes feel it's really hard because we're relatively new as a university. The clinics still look at us as they did with the older students who had all these lectures and didn't have to read as much, so they won't understand if we say that we need time to read. They ... ah ... they'll soon be mad and they will be impolite and, you know, because they say you were not there, you went home yesterday afternoon ... I want you to be here, and it's hard to get home at five, six because we do need to read so much. So sometimes it feels really hard. Because there's not enough time to read ... sometimes I wish that the time at the hospital would be more rewarding, because sometimes you can go for days and you don't really learn anything ...

In the next quotation, the student is happy with the personal aspect of the education and unhappy with the work-load caused by spending much effort obtaining learning skills of one's own accord. These are coupled with the frustration brought about by the uncertainty and ambiguity in the content and process of the program as well as clinical education. One lengthy statement from a LiU-ten termer:

> (P58) Eh ... let me see... in the beginning ... the first terms were very hard. They were tough. They were the ... absolutely the worst or the toughest ones in my whole career as a medical student. Because there were so many ... new ways of dealing with learning, learning ability, so, you know it was a struggle to find a way that suited me personally best to ... to acquire ... enough knowledge ... and also there was ... always a nervous uncertainty about whether you would manage, if you were suitable for this kind of study ... and ... if you covered everything which nobody told you ... you have those frames which ... which they give you every term each ... person responsible for courses ... eh ... presents all these goals for the term, but sometimes you know they're very diffuse, you don't know really what they mean. Ah.. and sometimes I felt, especially at the beginning everyone was new in the system, even the ... teachers ah ... felt like we didn't really achieve the

> goals, we were all floating a little bit. It was very frustrating, very frustrating. So it depended very much on how the group, worked and how the tutor functioned and usually not very well. Because he or she probably didn't know how to handle ... everything. It was a new situation for them too ... ... so ... I was not very satisfied the first terms. It was quite frustrating. ... the quality of the education must improve, I think, particularly the quality of clinical education, while the practical part is so important. As I said before there is a difference between different clinics. Because the supervision at the different wards in clinic has been disappointing. One felt oneself like outsider and did not receive the teaching one should have got. In different wards when one has been working with doctors or on another practical occasions, ... they referred us to books ..., because they think that we are supposed to solve our problems. This is perhaps a reaction to the system ..., I don't know. But otherwise it was a very good experience... it was a good thing to ... you know, learn your own limits to what you can achieve, what you can ... eh ... a ... go through, I mean eh ... But it had its price.

Two excerpts from GU ten termers in which they complained about teaching-learning and teachers' attitudes:

> (P13) There have been a lot of obligatory studies, laboratory work, endless lectures every day, so that you have had very little time to read articles, for instance. ... to get copies of old exams and learn those by heart. It has been like they have given us a big book and said 'this is the human being with all his or hers illnesses, etc., learn it by heart, and then in five years you will get your degree. ... uninspiring, and very much in the clinic, it has been more important that you to go there every day, that you say very little, that you don't bother the doctors while they are working and very little enthusiasm to teach us how to work as a doctor.

> (P10) ... But I think they should pay more attention to the students' need out in the clinic. Because a lot of times they are not there or they have to work and they like we aren't not really ... A lot of time we are out of place you could say. There isn't any space for us. Like the nurses have their student nurses whom they care of. But you don't feel that every doctor really tries to take care of his undergraduate, I'd say. ... But I think that's bad. I mean they never try, many times you feel that they don't try to understand their pupils everyone no it's a bad system, and that's significant I think, for the medical system as a whole.

In summary, the greatest impediment for the GU students seemed to have been the teaching-learning approach and method of assessment whereas these aspects brought enjoyment to LiU students. Similarly, work-load in different forms created difficulties for some of the LiU students, particularly during the early stage of their education whereas this did not seem to be a major problem for GU students. Some of the ten termers from both universities complained about clinical education. Their complaints revolved around the inadequacy of the content of training as well as teachers' inappropriate attitudes.

Students' attitudes towards university education

Three main attitudes towards university experiences were found in the answers. The first type of answers are the ones in which participants express their satisfaction with their studies. Some examples:

> (P12) It's stimulating with a lot of new friends and I've had quite a pleasant time here.

> (P36) Very positively. I think it's very good. Because it's quite new and quite small which makes for good contact, or it's easy to have contact between the professors and all those who have ... lessons with us ... and the students, so you don't feel that you can't ask questions, I mean, if we meet a ... some professor or one of our lecturers when ... when we have our coffee break, we can talk with them then if there's something we wonder about. So there is ... good contact that way ... and we've got a lot to ... say about ... what's happening and how ... how they develop our education and new things and ... bad ... bad things ... we can get better, so ... I think it's very good.

As can be seen in these two excerpts students appeared to be happy with university life regardless of the nature of their statements.

The second type of answers were given by students who were partly satisfied with their education. In these answers, the proportion of either negative or positive views varies, that is, in some statements the negative view dominates whereas in others the reverse is the case. This could vary from statements like; *"It is heavy but it is fun" or "enjoyable, interesting, exciting, free ... hard"*, or *" ... but as a combination it is not very good."* or *"what I think about them. ...,well I think it's interesting ... and sometimes very boring. Well it's ups and downs sometimes interesting ... very interesting and sometimes very boring"*. to comments such as:

> (P43) ... You ... most of the time I do like it. Sometimes ... there ... the organisation is not always the best. The communication between faculties, between people. It happens when you ... we go out at the clinic ... they are like what ... what are you doing here, who are you? And that ... that is frustrating because you feel like what ... what ... aren't we important ... but basically it does, it's good. I like the ... the way of studying, I like this. Yes, but then ... I mean they ... they should be ... and then you ... they look around and they feel like ... and they find this small note that they haven't read and like oh, yeah, oh sure ... so what are we going to do? And that makes me angry. It's really frustrating.

or:

> (54) It is so far ... I think I am quite satisfied with my studies, on the whole. But as it is a new ... quite a new way of ... of studying the tutors and the people who have the lectures ... they are ... they are not ... they are getting more and more used to it but in the beginning they weren't used to it at all. And it was very ... sometimes it was very hard to communicate with it ... and with each other. So there are some 'child diseases' with this education It has been frustrating for us that

> none of the teachers and tutors knew what the whole curriculum was about.

A third category of answers comprises those participants who are completely dissatisfied with their experience of university. Two examples:

> (P15) ... I don't like that model. Because I think they should be more interested in the students and I think that we should practice much more and that they should make sure that we learn the things that we are supposed to learn. Many courses, the teachers, they don't take their responsibility and they have very good goals but the goals and what we know after the courses they are not very much the same, and I don't like this model you can easily make it work and get through the courses just by reading old exams and it's too easy to just pass through without knowing, really knowing things.

> (P41) Eh ..., ... it might be negative that we ... there is not one single person who follows ... our class ... eh ... through ... the whole ... the whole program ... or ... not even ... I think most of the teachers we ... we meet ... two or three times ... and ... and I sometimes think that ... they ... they don't ... eh take responsibility ... just their little ... piece ... of ... of the whole thing ... they don't ... that ... the .. they come ... the teachers ... come and they ha ... and they have ... two hours or four hours ... with us ... and then they ... they don't ... well, they're happy to walk out ... walk out of the ... hehe ... of our lives ... or ... of the class ... when they are finished ... and ... and ... so no one sees ... no one has the ... overview of ... our situation or no one knows what we ... what we know and what we ... haven't learned yet ... so ...Yeah, the ... the teachers ... sometimes ... sometimes they ... they start at a too high level for us ... and sometimes they don't know that we ... well sometimes they start too low. So they seem ... it seems like they ... they haven't any idea of where we ... stand right ...

The table below covers the nature of feelings the students expressed about their university experiences.

Table 14. Students' attitudes towards university education

Number of students (n=60)

Attitudes	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Positive	11	5	7	2	25
B. Partly positive	-	6	1	2	9
C. Negative	4	4	7	11	26
Total	15	15	15	15	60

It is, however, necessary to note that in the entire body of data there was not even one occasion where the idea of abandening their medical studies was considered even by the most dissatisfied participants. An overall impression of the material is that no matter how students felt about their university studies, they were very much interested in studying medicine.

Students' expectations of medical education

In order to obtain information on the above-mentioned issue, students were asked the following question: *"Is medical education more or less as you expected?"* The data were treated in the same manner as in the analysis of students' experiences since it was found that the answers had the same character. Therefore, an analysis of the answers was performed initially, based on the content of the answers and secondly on the students' agreement or disagreement.

Two categories emerged from the analysis of the content. The second analysis yielded almost the same pattern as was the case in the data on the students' experiences of university education, that is, three types of statements were recognized with respect to whether or not the actual studies coincided with students' expectations.

These ranged from those who did not have any kind of thoughts whatsoever about how the medical education should be; to those whose expectations coincided either partly or very well with what they were exposed to in higher education; and finally to those whose image of medical education clashed completely with what they actually experienced.

In the following first the results of the content of the students' comments will be described. Then the students' opinion as regards the degree to which their expectations were met in reality will be presented.

The Content of the Expectations

The comments students made when answering the above-mentioned question, appear to be of two kinds. One type consists of answers that only deal with what the medical education *per se* should be about. In other words, they only emphasize how students approached the learning activity or how teaching in higher education is accomplished. The second type of statements, which incidentally, includes only three participants, appears to be more about what medicine as a profession in general can do in the treatment of patients.

The first type of answers, as was mentioned earlier, concentrates on the different aspects of medical education as was more or less the case in the students' comments on their experiences of university education. These comments differed from each other in terms of the aspects they focused on.

This way of thinking is illustrated in the comment below where one of the LiU ten termers said that he or she expected that clinical training would be more than doing the routine work of admission and discharge of patients:

> (P46) Oh ... it's so many years since I started. ... what I expected ... more or less, maybe I thought it would ... hm ... more education and less everyday work. Because there is quite a bit of everyday work. To register and discharge patients, and I thought there would be more time to learn . Because you can go on for weeks and there isn't anyone who has any time left to talk to you about anything. Register and discharge patients, and write referral letters and eh ... you know, there are so many people with so much knowledge if they just had half an hour a day, maybe two of them had half an hour a day that would be one hour a day, that someone just, you know, told you some of their knowledge. But I think as long as education is not, you know, they do their research and they get money for working but eh ... teaching is not very highly valued ... No, not at all, so they don't, they don't take their time not even the big guy, you know they don't have time. So what you do is you try to find those few people who really enjoy teaching and then you try to stick with them. As much as you can. But I think there's so much they could give.

A second type of content that can be discerned in the interviews is the one where participants dealt with the outcome of medical education. Here, the target of interest is the product of the medical education; doctors, and what they do as professionals:

> (P54) Ah ... it's hard to recall exactly what I assumed when I started. But ... because I ... I hadn't any experience of the medical field when I started so ... my ... my thoughts were very vague ... about what it was

> all about. But ... maybe I thought that I could cure and save many people I've understood now, but it isn't always like that. And that the ... in the beginning I thought that there were many truths in medical science ... but there aren't . That I have really understood ... during this time. I thought that there was ... exact knowledge about everything ... than ... and ... but it isn't. And when you come to the clinic ... there is even fewer of truths.. there are many traditions and there many yes ... traditions. And we do like this and normally it ... the patient is cured ... but ... the ... the other time the ... patient isn't cured and they don't know why ... and I don't know why ... and ... yes, there are so many questions still in the medical fields ... that I didn't ... I didn't know about that when I started.

What can be seen in the quotation above and other statements of this nature is that students expected that they would be able to cure many diseases and help patients after several years of studying medicine. This expectation, according to the student, could not be met in reality due, among many other things, to the limits of scientific knowledge in different medical fields. Gradually these high hopes and idealism are replaced by realism.

The distribution of the answers with respect to expectations of the students is shown in table 15.

Table 15. Expectations of medical education or medicine

	Number of students (n=60)				
Expectations	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. Education	15	12	15	15	57
B. Profession	-	3	-	-	3
Total	15	15	15	15	60

Almost all the students talked about their expectations of the medical education *per se*. Only three students (n=3 LiU Term 10) commented on medicine as a profession and what it can do with respect to curing the patients' ailment.

Students' expectations: direction of attitudes

About one fourth of the students said that they had not had any idea what medical studies would be like and therefore had not expected anything:

> (P27) I didn't know anything about medical studies so I didn't expect anything, I just took it and did what I could do with it.

A second group are students whose expectations have almost been realized:

> (P29) Yes, it is. I have heard that there would be a lot of just learning by heart, not so much practice until the later terms. So it is as I expected, but it has been easier up till now than I had expected it to be.

> (P32) Yes, more or less, but I could say that I didn't have so many expectations before I started, I didn't know anybody else who had been studying or anything so ... but ... yes, more or less.

> (P24) More or less. Perhaps more ah ... well I thought it was perhaps ... I didn't think it would be so much upper secondary school since I was, yes, doing other things before. And then it's just like, coming back to school.

A third group of answers consist of those whose expectations have not been fulfilled after several years of studies. This group of answers comprised both students who have positive as well as negative views regarding their expectations on medical education. An overall impression is that GU students' real experiences of medical education is worse than their expectations whereas the LiU students' actual experience is much better than they expected it to be. In other words, when there is any mismatch between the expectation and the reality, it is of a negative nature for GU students and the reverse is the case for LiU students. Below, is an example where reality differs from expectations:

> (P13) No, I thought it was much more philosophically interesting, more questioning, more thinking, more discussing and I couldn't have dreamed that it was possible to be a doctor without buying one single book if you just got copies of notes from lectures and old exams. The importance of old exams is enormous at this university. It is possible to ... I think nearly every written examination if you have got enough copies of older ones, it is possible to ... you learn them by heart and then you ... I have passed at least half of my examinations that way and I have succeeded very well so, and it has been a great disappointment. Because if you try to read the book you have no chance, because when they ... as in surgery for instance, surgery was not the worst, but that was one example, if you read the book in surgery you could learn very much about surgery and then at the exam they ask you questions like, how many ladder operations take place every year in Sweden?, and if you hadn't seen that specific question you would have no, absolutely no idea. Or at which height are the collateral veins above the ankle and things like that. If you hadn't seen just that question and learned it by heart you wouldn't have stood a chance, because

> that's not the kind of thing you learn when learning a big text-book on surgery. No. But really I think that compared with other education program at the university it is this practice of using old examinations and just learning some professor's lecture by heart and then you go there and repeat it, it's scandalous.

As we can see, P13 is very disappointed by the fact that medical education never seemed to get beyond encouraging students to memorize discrete facts mainly presented in lectures as well as learning previous examination questions in order to fulfil assessment requirements. His/her expectations were rather to acquire a more questioning attitude, and critical thinking skills, during his/her university education.

The distribution of answers to the question regarding the expectation of the students as regards medical education is shown in table 16.

Table 16. Question: Is medical education more or less as you expected?

Number of students (n=60)

Expectations	LiU Term 5 students	LiU Term 10 students	GU Term 5 students	GU Term 10 students	Total
A. No expectation	3	4	2	6	15
B. Yes/ more or less	8	5	8	7	28
C. No	3 pos. 1 neg.	4 pos. 2 neg.	1 pos. 4 neg.	- 2 neg.	8 pos. 9 neg.
Total	15	15	15	15	60

'Yes/more or less' answers, are the largest category. Those students who thought their expectation had not been met in reality form the second largest category of the answers with 17 students. The reality of the medical education for the LiU students appears to have been more pleasant than they had expected, whereas the reverse is the case for GU-students. 15 students stated that they had not had any particular expectations when they started their medical education.

In short, whether or not students' expectations had been realized, they seemed to choose to get on with the curriculum requirements in spite of being quite dissatisfied with the education. This is particularly true of GU students who can more likely be considered as having an dissatisfactory view of their education.

Chapter 14

RESULTS: REFLECTIONS ON THE PROBLEM-BASED PROGRAM

This chapter deals with the responses given to the question: *Can you tell me what the PBL program means to you?* which was given only to the LiU students.

The aim was to find out what kind of conceptions students have as regards the PBL curriculum applied in Linköping.

The analysis covers conceptions discerned in the answers to the above-mentioned question.

The result is a description in four different categories. All except three answers are value statements as was the case in some of the earlier analyses. Three answers, as was mentioned before, are objective in that they only gave a definition of what PBL is.

In responding to the above-mentioned question, students mostly focused on one characteristic of PBL as being the most important attribute of this teaching-learning approach. This means that they either expressed the significance of having self-directedness in their studies, the importance of learning in the real life context, or they emphasised the important role tutorial group work plays in the learning situation. A combination of conceptions forms a fourth category where the students commented on several features of PBL.

In the final category, the students objectively defined PBL in very much the same way as a particular word in a dictionary is defined.

Category A. PBL means self-directedness in study activities

The importance of self-directedness is stressed in this conception. The answers indicate that the PBL program respected the students' self-directedness in educational activities.

Below, are two examples where the students are very happy that they can take the initiative and responsibility for their learning. Students seem to have control over their learning process. In other words, they can decide what to learn, whom to get information from, where to seek information, how to learn and over what period of time:

> (P23) It means that I and the members of my group are the ones who set up the problems and ... and also decide what to learn and ... when to learn ... and what books to ... to read or what persons to ask. I think ... the most important thing with problem-based learning for me, is that it's not settled from the beginning exactly what to read, when to do it, where to get the information. I like that very much, because I ... you can do a lot to change things and ...

> (P12) Ah ... ah ... what I would most associate with this is ah ... ah ... learning how to ... to decide for yourself ... ah ... what is important and what isn't. I think that's the ... at least for me that is the ... the most important part.

In the next quotation, P13 appreciates the fact that they were given a lot of freedom to conduct their education and that they are free to quite a large degree to pursue those ideas that excite them. Furthermore, the student seems to be pleased by the fact that the teachers rely on the students' ability to form a judgement when it comes to seeking, identifying and locating information required for educational purposes:

> (P13) It means ... that ... the people who are in charge of our education ... they trust our ... us ... they trust us students that ... that we are capable of deciding what is important, what do we want to learn. It also gives me a lot of freedom to decide the ... this is interesting, I want to learn this ... more than other things, I can learn other things because I know it is important, I know I have to ... I have to know these things ... to be able to work, but ... may ... I just ... maybe I don't have to ... to learn as much as I ... could ... I don't have to learn any ... everything, but there is ... there are other subjects that I ... is more interesting ... that I could study a little bit more about. And also it ... gives me the freedom to choose whatever literature I want ... I can do ... having ... using the nurses' literature ... if I wanted to do that. Basically it's ... the ... the feeling that they trust us, that we are capable of doing it ...

Being able to pursue one's learning activity in one's own way during the university studies enhances motivation in the students. It gives the student not only the necessary incentives in his/her learning activities in order to be able to complete his/her education but it may also result in a positive attitude on the part of the student toward his or her education. These ideas are expressed by the next student:

> (P8) It means freedom ... in your way of studying, that I think is very positive, ... I think if I had studied the original ... pattern ... I think I would have got bored a lot earlier ... I don't know, I haven't studied that way so I don't ... but that's what I think I would have got bored a lot earlier. Here you can have your down periods ... then you read a little less and you're not as interested ... And then you have another period when you think Oh, this is so fun! you read a lot ... so ... sometimes you're a little bit behind and sometimes a little ahead and in the end you're ... well, you are where you should be ... .

Being self-directed in learning, as is shown in the next excerpt, is considered to make learning material more interesting than it could otherwise have been:

> (P22) Mm ... eh ... I think that PBL ... is ... eh ... P ... I think that PBL eh ... is a system ... to create interest in the facts that we learn ... eh so we will be stimulated, solve problems not to ... not just have to learn because someone else has decided you have to learn this ..., ...

Having the possibility to decide for oneself what is relevant to learn and what is not seems to make learning more meaningful. This is in contrast to the secondary school education where this decision was only made by the teachers which was normally not appreciated by the students.

This idea is illustrated in the next excerpt:

> (P3) yes ... it ... I like it ... it is meaningful ... and ... study this way . I have often thought in upper secondary school that ... we wasted our time ... doing things just because teacher wanted us to do, or ... ya ... it was felt that the lessons were not used in a right way, it was wrong, one can say ... - ... and doing small details that had nothing to do with the big whole. - So, now it's more meaningful, one can say. ... Aa ... the main idea is to understand the connection and the overview, more than..., ... little things ... and it feels right and it makes it easier to learn.

Category B. The importance of real life situations

In the B conception, importance is attached to real life contexts of reading. The answers in this category said that in the PBL program learning occurs in contextually relevant formats. In other words, students appreciate that they are studying medicine in a context that approximates the future situation where their knowledge will be applied.

Study objectives appear to become more interesting because they are learned in real life as the following student puts it:

> (P10) Mm ... well, what should I say, it's a study form that makes the subjects more interesting to read ... and to get it into context with real life situations ...

Next, is another quotation where learning in the actual contexts encouraged the student to get along better with his or her education. In other words, PBL, by having incorporated actual learning contexts, made medical education more interesting than it would otherwise have been:

> (P11) Eh ... it means very much to me, because it's ... I think ... that PBI is the only way ... that I would like to read ... because if I ... if I had to read in and ... another ... technique ... eh ... I don't think I would be interested in ... in medicine ... any longer ... eh ... eh ... ... eh ... I think PBL is very ... is very stimulating ... just because we ... we use ... you know descriptions of patients ... and it ... it's somewhat more ... more ... real ... eh ... it is real patients ... and ... it is about ... it's all about ... to ... to solve their problem ..., ...

In the following comment, the student seems to assume that learning in the real life context helps them to get well acquainted with the reality of their prospective job situation. It may also be of great importance in helping the students to be relaxed when dealing with patients and their problems in the future:

> (P14) ... it's ... it's interesting to ... to work from a patient ... I understand the patient situations ... already ... now ... so ... you ... I'm more

> used to it ... when I meet ... when I meet the patients ... alive ... In the future ..., ...

The PBL approach, as the next student pointed out, at an early stage of the education, provides the students with knowledge as regards their future job so that they are able to determine whether being a doctor is actually what they want or even more important whether or not they are suitable for this profession before it is too late:

> (P4) It means that I ... it gives me the insight about my future job. Without it I would not be able to know what it means to be a doctor. And I would never have got time to think about whether I really want ... so ... before I start term six. But now, all the time I have got ... to learn this ...,

Below, is an example where the student is pleased at the fact that the patient problems are taken as a point of departure in their learning process at the same time as there is a criticism about the examination format which is not constructed to meet the requirements of PBL:

> (P15) ... ... when I start with problems and questions. It works very well. But many times I don't and I think it's partly because of the exams ... because you get stressed by the exams and we know we have to read all this. Even if it interests us we have to read it ... that contradiction ... and they tell us to read what we find interesting and then they ask questions about what they find interesting ..., But I don't think that ... the exams really are problem-based learning. Well they are kind of ... they are ... yeah, the structure of the exams is problem-based kind of but ... not really. I don't think they are perfect

Category C. The importance of work in groups

The significance in this conception is allocated to working in a group. The prominent characteristic of the answers in this category is the fact that working in the group is considered to be an almost ideal setting for learning in different respects.

As we can see in the excerpt below, the tutorial group contributes to an effective and efficient way of learning by creating a learning environment in which the students are actively involved in the learning process. Having learned this way, as the following excerpt shows, makes it easier for the students to remember what they had learned in the exams:

> (P19) - Ah ... ... you work in groups, which is also very important. A lot of trouble in the beginning with the group and so on, but in the end it is very good ... because you learn a lot reading yourself but then discussing in the group as you remember when you're sitting there at the test then ... ah, that's that thing we ... we discussed in the group. You have to go up eh ... to the board and make some notes and so on. So this problem-based ... it is the problem, the case is the important thing and that you ... you try to get ... a wide ... Analyze or you ... you try to see many ... to see the case from many points ... also because there are a lot of people in the group ... see the, the case from different perspectives. But then you, when you have this ... done this brain-storming as

> we call it ... you try in the group to sum up and to get the, the best points of it and the most important things as you read. ...

In the following two excerpts, the appreciation of contributory role of the tutorial group in the learning process is expressed. Students also mention that conflicts in the individual student's interest might present themselves during these sessions which sometimes makes the work less interesting than it could otherwise have been: (This latter issue is also indicated in the former quotation):

> (P24) Ah ... mm ... I think it's ... a ... very good way of learning because for me it's getting much more interesting that way, ... when we ... in the group ... do some brain-storming ... and then we got those questions and then it becomes much more interesting to go home and search for the answers to those questions. Then you come back and you discuss and you don't agree with the ... certain things and you agree with ... others and ... yes, when it's functioning ... ah ... then it's a very stimulating way ... of studying, I think, But then ... there are great differences between different groups ... because we change group each term and some people are more or less interested in brain-storming and discussing ... and so some are not If we are in a group with people interested in brain-storming and discussing things then it becomes more interesting and a little bit less interesting if the people are more rigid ... so to speak.

> (P26) ... working in these tutorial groups then you have the opportunity to ... to have a discussion and in that discussion, ... if everything works my way, so to speak ... then I have the opportunity to ... sort of figure out what do I already know ... and what do I have to find out. Because otherwise if I just sit down with a book, I never start thinking before what do I know of this subject already ... and what is it actually that I want to know. But working in this tutorial group, I have already sorted a lot of things out. I have a purpose for reading that specific book going to that specific article ... ... And then you have a very much higher motivation to study. Well, working in a group there's different individuals, ... different views of how things should work ... and some people ... like very much to have ... someone giving a lecture and have everything served for them, and also a lot of people find it very frustrating to start discussing ... without having read that chapter in the book before ... but I find that very rewarding because then I know what I already know.

Group work can be useful for improving students' communication skill:

> (P4) ... I learned to co-operate with the most strange people.

Category D. Combinations of conceptions

This category includes answers where students expressed combinations of conceptions.

Below is an example where being obliged to contribute to the progress of the group work is considered to be a kind of motivation for learning. Furthermore, working in groups makes learning more active due to the op-

portunity of having discussions with the group members regarding different learning issues. Learning in a context which resembles the professional situation is also appreciated by this student. According to this statement, it provides students with a holistic view of patients, prepares them to deal with patients and their problems in the future as well. Moreover, the students acquire a kind of self-knowledge in that they are able to see whether they are capable of being a physician before wasting several years of their time. As we can see, this student nevertheless, does not refrain from expressing a great deal of intellectual uncertainty:

> (P6) I think it's good. One thing is that you ... I feel ... I have to learn ... ... because if I didn't ... wouldn't do my ... reading between our group meetings and so, I wouldn't have anything ... to give to the others and ... the worst thing I can do now, I think, is to sit at one of these group meetings and not be able to be in the discussion because you feel you haven't read enough and you have to read more and so ... and ... also this way of reading in groups makes you ... you discuss what you've read as well, and you ... quite a lot of the learning is about discussing what you've read and ... to see if you've understood the things in the right way and so and that's ... the best ... I think. And also the way they've ... changed our subjects that we don't read them one subject at the time, but we read about the whole ... body instead, I think that's a better way, because that's the way the patients will be when we get out and meet real patients. And also that ... we're allowed to meet ... patients much earlier than the other systems, I think is good, because ... there are quite a lot of people I think who go into medical studies without knowing ... anything about how a patient works and how you meet a patient and talk to a patient and so on. If there's ... if they don't know if they are suited to be a doctor or not ... and by meeting patients so early it's an easy way to realize if it suits you or not, so you don't have to have all these doubts and so before ... five years of studies and you suddenly realize that oh, I don't want to be a doctor, that's a bit of a shame. And ... I think it's harder though, than the other way of reading, specially in the beginning before you learn how ... it's always in ... unsure ... you're not sure if you've read enough or read too much or too little and ... that's hard because in the other way of reading, I think they've got greater security in if you ... if we read these ten pages and know the ... what they say, we know enough, but we never know or hear from our tutors if we know enough or not, that's ... but ... on the whole I think our system ... is very good, because we get to learn ... because we want to learn and not because somebody tells us to learn a thing. And I think that's important for .. long-term learning, sort or.

The following quotation is another example where the student says that PBL means being actively engaged in the learning activities, having the opportunity of elaborating on the knowledge learned. He or she also positively emphasizes the effect of the '*Strimman*', which refers to the kind of 'doctor-patient communication training' the students get during their education at the same time as the quality of some of the cases is criticized:

> (P7) It means ... very good way of learning. Just discussion ... the combination of first reading and then discussing your knowledge, what you've learned and in this they get more ... establish them you

> get to express yourself, you get to use them actively and not just passively, it doesn't only have to get inside you, it also has to come out of you. Important, incredibly important too. Then ... problem ... just this thing about problem formulations and that one then that one sits and takes the cases and so on, I that's also good. the cases may be a bit badly written now and then, many people complain that they could be made more stimulating so that they would arouse more enthusiasm in us, but it's and then the large ... part I also think the organ based learning system is ... just that we ... that one doesn't study ... subject by subject, anatomy, physiology, biochemistry, we take the organs as such in ... one studies the stomach, one studies the liver, one studies the heart ... in one go, everything at once, and it can become ... it can become disconnected and you jump between the different subjects ... but I think that's OK because then instead you get the whole organ as such, as a whole ..., Stream, which we have is ... well, it's what's most interesting in this course of studies, I think. It's an awfully good thing to have. And now ... it's my last term at ... with Stream now ... I feel that when I go to the clinic next term I will be prepared to meet patients. I'm not afraid of that ... or we could say that I won't be at all ... as nervous as I know I would've been if I had never talked with a patient before and only been here two and half years and only studied, but now I have ... I feel that I'm really well prepared ... to go out and meet them. I suppose it's the parts I think are important, which worth taking up.

Category E. Definition-oriented answers

The answers in this category say nothing but the very definition of the PBL. An example:

> (P28) Mm ... uh ... it means that one has problem, a case ... which ... you in a small group of students together with a tutor, eh ... define you define on the basis of ... they call it the seven steps ... where you try to understand the text, where you later try ... eh ... fantasize or ... brainstorm ... about the problem, about the case ... the case should stimulate you to produce questions ... so that the problem as such will stimulate questioning. And by questioning and presenting questions and descriptions of aims ... or ... questions you arrive at the description of the aims, what it is I want to know, what knowledge I should acquire to be able to get answers to these questions which ... are related to ... the case. That's how I see problem-based learning that one acquires knowledge on the basis of a problem. Which stimulates one to produce question and then the acquisition of knowledge in order to solve the questions and gain a greater understanding of the problem.

Category F. Unspecified answers

The students in this category did not actualize any particular topics in their answers. They merely expressed their feeling about the PBL program.

An example:

> (P25) I'm not the right person because it doesn't mean so much to me. I think I have ... I think I ... of course I ... I'm learning that way too,

because we have so few lectures ... but ... I don't think about it every day or so ... I'm just ... now I'm learning

A summary of the categories is given in table 17.

Table 17. Reflections on the PBL approach

Number of students (n=60)

Category	LiU Term 5 students	LiU Term 10 students	Total
A. Self-directedness	6	6	12
B. The importance of real-life situation	4	-	4
C. The importance of work in group	1	3	4
D. Combinations of conceptions	3	1	4*
E. Definition answers	-	3	3
F. Unspecified	1 pos.	2 neg.	3
Total	15	15	30

As can be seen, category A is the largest one, equally distributed over the two groups of students.

Ten termers are more in favour of group work, whereas the importance of real life situations seems to be more focused upon by the five termers.

The F category includes three answers which, although they in general contain a combination of both negative and positive points of view regarding PBL, nevertheless cannot be placed in any of the categories due to the fact that the answers did not contain anything that would be indicative of the categories described above.

It is necessary to mention that 10 out of 15 five termers reported positive experiences of their curriculum. The remaining students gave both positive and negative comments.

Among 15 ten termers, 9 students had positive points of view, 4 with both positive and negative standpoints, and 2 students with mainly negative experience. Although the two above-mentioned students had mainly a negative perception concerning their curriculum, they nevertheless said;

(P17) ..., because I'm not the type of person who likes that, ... but of course may be it's easy to remember if you have a case report to remember together with the facts... that

part is good, but. ...'; and the other: '*(P25) ..., I'm not the right person because it doesn't mean so much to me, ..., but .we have these 'seminars 'or like ...- Tutorial groups, that's something that's good' ...'But it's very good.*'

In short, these two students said that they do not see much of a difference between PBL and the traditional curriculum.

* The different combinations of the concepts consist of:

3 (B+C)	The importance of real-life situation in combination with the importance of work in a group; n=3 LiU five termer
1 (A+C)	Self-directedness in combination with the importance of work in a group; n=1 LiU ten termer

Chapter 15

SOME ILLUSTRATIONS

So far, we have tried to illustrate the differences between the two groups of medical students. With respect to students' understanding of the content of the learning task, the least represented category, as noted before, is A. B and C categories of answers are most represented and comprise more or less equal answers from different groups of students. When it comes to learning approach it seemed that students from LiU were more inclined to apply a deep-level approach to learning materials both in general and when reading the study task. As regards experiences of university education, the inter-group differences were substantial and intra group differences were small.

In the following, I will use four students to illustrate the way in which the student's reflections on medical education, approach to learning and learning outcome are related to each other and to the educational context. When looking at these cases we can see that when the students arrive at university they have certain expectations about what university education can do for them, or what they can do with it. These expectations do not always compare favourably with reality.

The differences between expectations and reality vary as to degree of importance to the students. The more fundamental the discrepancy, however, with regard to the students' expectations, the more difficult it may be for the students to enjoy their studies at university.

Sometimes, it is very clear to a student already from the beginning that the education is not what he expected and will not provide him with the opportunities that he needs to meet his goals and sometimes this insight comes later. Some students seem to resolve the conflict at the start by compromising, i.e. reordering priorities, settling for less than they wanted or neglecting for the time being their expectations and concentrating on delivering what is required of them by the educational system and some students have problems in figuring out how to deal with the system and its requirements. Other students have a few of these problems and some have almost none.

The aim of this chapter is to illustrate how students' expectations and their perceptions of the educational context is confronted and how different patterns of learning approaches have been developed by the students. The relationships between the conception of phenomena ultimately become integrated within the individual to form a comprehensive picture of their lived experience of higher education.

Illustration one

Per - a student from GU term ten

Per is one of the students from GU term ten, whose experiences of medical education very much contradicted his expectations of it. Looking through the whole interview with him shows that at the beginning of his studies, he understood quickly 'what was going on' and tried to 'fit into the system' by doing what he assumed the system expected of him. When he reflects on what he did then, he does not seem to be happy about it, saying 'it was the time I was disillusioned, so I was happy to be able to fit into the form'.

He still does pretty much the same thing now. The difference is that now he resents what he does. Throughout his studies he compromised his aims and focused very much on the courses and completed them successfully.

In general, Per's main concerns, when reflecting on university education, have very much to do with the way in which he has been taught, the objectives of the program as well as the examination system.

His expectations of university studies in general, and medical education in particular, were challenged when he found that the main concern of the program centred on the acquisition of factual knowledge. Objectives such as 'questioning, thinking, and discussing' were given little opportunity to be developed and he was very unhappy about this aspect of the program:

> (Per) I expected very interesting studies where I could learn a lot and acquire a lot of understanding of the human condition. What it is to be a human being, how my body works. How my mind works etc., and there has been very, very little of that I think. I thought it was more thinking, more questioning, more thinking. It has been like reading the bible in a bible school in the seventeenth century and then nothing more than that.

As illustrated by the excerpt below, first of all, Per is dissatisfied with the fact that he has not noticed any difference between secondary and higher education, e.g. he has not been treated like a university student. Secondly, he is critical of the fact that they are engaged in rote learning, concentrating on finding out the answers to the previous test items, memorising them and passing the examination. If they were to read books instead, he says, their marks would suffer because they would not be able to locate all the answers to the questions they might get in the examination:

> (Per) ..., there has been a very little of a academic course of study. It has been more like a continuation of the upper secondary school. We have been treated very much like children, disobedient children. ... to attend to every lecture, every laboratory lessons, to get copies of old exams and learn those by heart. Because if you try to read the book you have no chance, ...

When talking about the kind of knowledge the students were expected to know in the examination he said that examinations are primarily concerned

with factual detailed knowledge. In this respect, he pointed to the very interesting fact that his concerns in the beginning of his course of studies were to 'fit into the form' which is why he did not bother to try to understand the knowledge they were supposed to acquire, something which appears to be a disappointment to him now. As far as the work in the courses was concerned, Per kept very much to what was required by the assignments and the assessment system. The comment below shows that he is fairly strategic. He seemed to know what the system wanted from the students and tried to take them into account in order to succeed in his studies:

> (Per) things that you could learn by heart, I never understood what that really was but I could answer ten questions about it. Like how it was regulated etc., etc., but I never understood what it was all about. But that was never tested in the examination.
>
> I: Couldn't you ask what it was for instance, the meaning of it?
>
> (Per) That was at a time when I was already disillusioned so I was happy to be able to fit into the form.

It seems that the examination system is more concerned with reproduction of facts than testing concepts or the ability to integrate data.

The clinical part of the education to some extent helped him towards fulfilling his expectations. It is clear that Per had become more interested in his education because it related more to the job he had been training for:

> (Per) The meetings with the patients have been very important to me and the rest, well I have learned a lot of things but I think that it has been on a very basic level and that it could have been made much more interesting. I think that it surprised me a lot because it was not at all as I expected but I think that now I can say that it has been the meetings the patients that have given me the most.

Now, during the clinical phase it seems that he is acting in accordance with both the requirements and his interests. The following statements refer to the former issue where he talks in turn about the kind of knowledge he remembers best, how he approaches learning materials as well as how he prepares for an examination:

> (Per) The things that they will ask about in the examination and repeating it, repeating it.
>
> (Per) No, I don't formulate questions to myself, no, I don't. But if I have seen an old examination question about the incidence of neoplasm, when I read about neoplasm, I underline incidence and I write it down on a piece of paper so that I remember.
>
> (Per) Before the exams I take out the ... I try to read the book. Because that's the only thing that doesn't bore me. But the last weeks before the exam I read the book and I check the old examinations so

> that I don't miss points that way, and I reread the notes taken in the lectures.

The way in which he went about reading the learning task, indicates that he has utilized a superficial learning approach:

> (Per) I read it quite carefully and made some sort of little notes in the margins and then I when I'd finished it I went back once and just checked my underlinings and my key-words.

As was mentioned above, Per also followed his interests and went beyond just meeting the requirements and used books more during the clinical phase. He still felt that the practical side was lacking but seemed to try to take measures to overcome the deficiencies:

> (Per) If you have sharp elbows, do you say so? You can get a good medical training, I think that I have had a good medical training. I have tried most practical experiences, practical things, I think it has been quite good. But it requires very sharp elbows. To say I want to try it. I want or I won't! I want to do this! I don't want to look at another sternal punction, I have already looked at ten, now I want to try it. Then you get the possibility to try it. If you just stand there, they let you stand there.

Comment

The overall impression that we get from the whole interview is that, generally speaking, Per appears to be unhappy about the university education due, among others, to the fact that he has experienced an education that is not at all similar to what he had expected. He came to university with a clear interest in academic work and found the content of the program of education quite contrary to his aims and interests. As we have seen, Per came to the university hoping to become an independent learner and is concerned that the program and the type of examination inhibits students' achievement of this goal. He found out very quickly what the system required from him and developed a strategy to meet the requirements. When we look at the way he read the learning task and his way of studying in general, we realize that he is very strategic.

At first, he was not all that uncomfortable with this. In other words, the formal requirements initially took over the direction of his studying. But as time passed, it became more difficult for him to only do what was required by the system and neglect his aims of studying medicine. His dissatisfaction increased during the clinical stage where he met the patients for the first time, and this gave him the insight and made him realize that what he was doing was not right. Now he is trying to take into consideration both the requirements and his interests. One way is to make demands on the teachers as regards what he wants to learn more about.

Illustration two

Ingrid - a student from GU term five

Ingrid is a student whose expectations were very much in line with the university education. At the start, it seems that she had some doubts as to which university to study at. Now she appears to be quite satisfied that she chose GU instead of LiU. This is evident in the statement below where she speaks of her experiences of university education:

> (Ingrid) I find it very interesting and stimulating. I think it is very nice. When I started I had some doubts about studying in Gothenburg or in Linköping, because I've heard much about their type of studying. But now I'm sure I think this is better. Better for me and I think it's good to have many science courses and a lot chemistry so you know what they are talking about when you come to the hospital.

When she talks about her expectations of the university it seems that she found medical education easier than she had expected it to be. When reflecting on this, she may either mean the ability to deal with subjects or the amount of effort or time spent to study them, something which is not explicitly spelled out:

> (Ingrid) It's easier than I expected. But otherwise it's almost the same as I expected.

Ingrid described how she went about reading the study task used in the study in the following way:

> (Ingrid) As I usually do, I read through and when I find something interesting I underline it and try to remember it and sometimes I wrote it in the marginal part. But it is not so often. I read it through and underlined the things I found important.

When talking about whether or not she remembers certain things more than others, she said that she would remember the things that are important for the examination:

> (Ingrid) Of course. Things I think they will ask about in the test.

The way she normally approaches her studies is illustrated by the following excerpt where she seems to be interested in connecting different parts of knowledge together to obtain a holistic picture of the issue at hand:

> (Ingrid) Not so many. They can be such big questions that you can't find just by reading it. But you have to think and take parts from many lectures and it's that type of question. For instance, what type of ... what factors will give a person urinary infection? Then I have to think over what it could be and ..., big questions. Not things that I have lined up at the lecture.

Preparation for an examination starts with looking at whatever old examination questions are available to the student to see 'what is important'. Then she reads books to check whether she understood them and eventually ends up with reading lecture notes:

> (Ingrid) Before a test I do very many old tests. First I start by doing old tests and seeing what's important, what they will ask about, and when I do these questions I use my books and read about things I see that I haven't understood and I read about it in the book. When I'm ready with that I start reading my notes from the lecture. I read them through once and then I go to the test.

When it comes to the examinations and the kind of knowledge required by them, she says that they are different and contain a variety of questions depending on the courses:

> (Ingrid) Some examinations want details. It depends on the course, on the subject. In microbiology you have to know all the names and details of the micro-organisms. But in physiology they wanted you to know the big things and to understand the questions and the subject and there was a difference, in different courses. The physiology course, their examination is oral, so they can ask questions that you can't ask if you have a written examination. It's a very big difference.

When talking about the most valuable thing she has learned, she pointed out that people should be treated individually not collectively:

> (Ingrid) That was difficult. I think it is that people are different and you have to think of it when you are with patients. You can't think that everybody is equal you have to think they are different, and how to treat them I think.

Comment

Ingrid is a student whose expectations are very much in accordance with the educational context. She appears to has been uncertain as to whether to study at LiU or GU at the beginning of her medical education, something that seems to have disappeared now. Medical education appears to be easier (whatever that means) than she had expected it to be. She says that in examinations both understanding of content and detailed factual knowledge are evaluated depending on what course they study.

Her description of the way she dealt with the learning task used in this study and in general, indicates that she switches between strategies. She applied a superficial approach when reading the article. She also uses the same approach most of the time in general.

Looking at the way she prepares for the examination, shows that first she tries to find out what would be asked in the examinations and then she tries to understand them by reading books and so on. This can be seen in her comments where she talked about the kind of questions she might ask herself. It appears that she wants to get an overall picture of some areas.

The most important thing she has learned appears to be how to deal with people.

Here, again, we have a student who clearly knows what the system requires and acts accordingly and is very happy about that.

Illustration three

Karin - a student from LiU term five

Karin is a five termer from Linköping. Her personal context and the educational context are in harmony in that what she encounters in the educational context is what she really wants from her education:

> (Karin) ..., As I usually say to my friends and ... at home it's just ... I've always been doing things at the same time so ... why shouldn't I read three hundred subjects at the same time and ... And I've never been the kind of person also reads first one thing and then another thing, I've always done everything in the same mess... and then it's perfect to study because everything is a mess and then you can ... find that you can make something out of chaos ...

She is enjoying herself very much and is comfortable with her university studies. She is very happy about the fact that the students are given a lot of freedom to choose what to learn, how to learn, to think, to make new friends and to develop:

> (Karin) I have had a very pleasant time. And then learnt much and I have ... enjoyed myself very much during these two and half years. When you feel that you can learn something that you are interested in ... getting to know more and more then you feel that I know ... I know this! I know how this works now and I can make my own ... way to work. I feel that I have learnt something I can use what I have learned in a new situation I can .. make connections between different ... eh ... subjects and ... Yes, that's what these ... this ... these two years have given me. Together of course with new friends and so on, but just for studying this ... studying has given me feeling that I can learn something that I want to learn and ... and ... and use it ... feel that I can grow as a human being, ...

She compares the way they study here with two other universities, and expresses her satisfaction at the fact that they are given the opportunity of intellectual questioning not carrying out someone else's wishes:

> (Karin) ... and just the feeling of ... I do what I feel ... do I want to read this and learn about this and learn about this and my group wants to do it, then we do it. If not ... too bad but I have at least made my own choice ... I have visited both ... Stockholm and Gothenburg ... we have friends studying at both places and ... their lessons ... and I just feel every time oh, I'm so happy I don' study like this. The feeling of we are just told that it's possible, that if this is true but don't believe in anything until you ... just the feeling that they ... they trust our judgements ... on ... possibility to learn ourselves and get the right thing out of it. don't tell that I ... I don't care what was in that book because this

> ... what I say is correct ... of course there are some kind of ... people there too, are trying to tell us that but we don't listen to them any more.

When reflecting on her education, she seems to believe that she has been studying within a secure setting where they were given the opportunity to not only communicate with each other in a fulfilling manner but also with the teachers:

> (Karin) But that's ... of the ... Faculty of Health Science is that's the way ... we very few people only thirty-five in each class, that's very few we have the chance to get to know each other person personally ... I mean ... - You have different form of contact you dare to ask people questions, dare to ask questions about lessons, you dare to ... just ask someone you please explain this to me, I have ... I can't get this, but ... the way it is, I feel it's very good. You can ... you have the chance to say that I don't like this kind of ... the ... way we are taught ... can't you change this for next year or something. We can influence, yeah.

When she expressed her conception of the medical education, she appears to emphasize the importance of being encouraged to persue one's own learning activities in accordance with one's interests, 'of course within the framework set up by the educational planners':

> (Karin) Just ... for me it's that ... I and my group ... are allowed to make up ourselves ... what we want to learn ... 'of course from the aims for ... the term, and you can ... if you're more interested in one field or the group is more interested, you are allowed to ... go deeper into that ... even if it's possibly not ... absolutely necessary for ... eh ... understanding, and that we are allowed to ... to do ... and make our own mistakes. No one is telling us that no, you would have to ... change ... well, of course now, when we're in ... as it has been for two years ... we feel and know of course much more and we can draw our own limits much more ... harder ... so that we ... in the beginning you ... you were very much flowing out at the sides ... now we are more concrete and make this and this ... because of today we feel like doing that. And dare do that and know that it's ... we won't fail at the test at the end of the term just because we have had great fun today and we have read about what we are interested in.- And ... just feeling that we are allowed to ... to learn ... in our own way, that we are allowed to take what kind of books we ... want to and ... makes it easy to read,

With regard to the type of knowledge she would like to remember, Karin says it is easier for her to learn the sequence of events, in contrast to learning the peripheral things where she has to make more effort:

> (Karin) Yes More important things, of course. - Could be ... big ... I mean the ... the ... the headlines of something or some kind of system where ... something happens that next time another thing happens I mean ... that kind of flow chart, I can learn ... but of course I make more effort to learn some things than others, some things are just peripheral I think ... as an example ... how you can get ill from different ... things and why they are or in which kind of population they are

> most useful ... I mean ... I can feel it's not so important exactly right now.

Karin's description of the way she read the specific learning task indicates that she had utilized an investigative approach to the learning material:

> (Karin) At first I just tried to ... see what she was trying to say ... was just searching for that ... and then I ... when I got ... when I had got what she wanted to tell me about ... I started to search for that and ... yes, and thought about ... I checked it with my own ... of course that little experience of this field, but ... and tried to see if there was something in this text that I knew about, a little bit more so I can make some kind of ... mm ... some kind of ... is this correct or is she trying to convince eh ... convince me about something that I ... don't like, I mean ... if they write ... very ... authoritatively ... I don't know ... eh ... and you can make me believe everything and I just check that it sounds ... OK, it sounds ... it's about something I've learned before ... it could be correct. And that the methods were ... is possible to ... see that kind of ... that you can use that kind of enzyme, so to say, ... that you have that kind of cells well, searching for all the ... inaccurate information ... eh ... it's not inaccurate uh ...

When reflecting on the way she deals with the learning materials in every day study situations, she says that she is interested in such questions as 'how' and 'why':

> (Karin) How, why. And then I try to answers them ... if we haven't asked those questions already in the tutor group, which is very possible then I have to find the answers ...

When preparing for an examination she starts by reading her notes and revising practical items. Then together with some other students, she reviews the old examination questions to know 'what they (teachers) feel is very important' or to get 'feedback' if they (students) have read enough and if 'they(students) know about it'. Reading the old question, as Karin puts it, might broaden their perspectives because the students discuss them from opposing perspectives. This way, she states, contributes to better memorizing of the learning material :

> (Karin) Read I go through ... just start to read my notes and checking up laboratory lessons and of course sitting in the ... well, for the practical examination doing what I'm supposed to do and put up a ... I mean it's just start reading and then we very often take the old test, old examinations and sit together in groups and discuss the questions ... never have the answers to the questions but two or three students you can discuss what ... what possibly ... is there to get out of this kind of question, ... I mean ... the kind of things they will ask about, what they feel is very important, of course is what the old test is about but also you can ... it's a ... I mean it's feedback if you have read enough and if you know about it, if you can answer the old questions. And if you are two, three, four students then you have two, three, four different ways to look at this problem, you can have ... from the same question some of us say this ... they want to know about this, and no, no, it's wrong,

> they want us to know about this, that way you learn two ways to think and that means you have a more, bigger field of what kind of things and then of course you remember much more.

Looking at the reflections she made on the examination system and its requirements, Karin appears to be not all that satisfied with it. She seems to detect a sense of discrepancy between the written educational goals and the way they are assessed:

> (Karin) They wants us to know almost everything. They still say that you should read so you have overview ... connections between subjects and so on, but there's still one person doing each question, still one person ... his or her field very important so often there is very ... and that depends too, I mean you can have a very good test and you can have tests that talk about just the very small details that someone perhaps has happened to read somewhere. It's ... it's also up and down, ... and I mean that can be from very good to very bad. It's no... good way to explain it. They aren't ... equal.

According to Karin the most important thing she learned during the years spent studying medicine was that she acquired a kind of confidence in her abilities as regards accomplishing things, when stating that:

> (Karin) That I can if I want. I can do what I want if I ... as long as I want to ...

Comment

Karin is also a student whose personal context and the educational context are very well matched. She is very enthusiastic about and satisfied with her education. This is exactly the way she likes to study, she says. According to Karin, the educational system encourages self-directed learning and interpersonal relations. The most important lesson she has learned from her education seems to be self-confidence and self-reliance. The teachers seem to assist students to learn rather than being conveyers of knowledge.

But nevertheless, she is critical of the fact that sometimes the system of evaluation is not consonant with the philosophy of the program.

Her description of the way she approached the study task and the way she normally reads the learning materials shows that she applies an investigative approach to the learning materials. Although saying that 'they still want us to know everything in the examination', she nevertheless seems to concentrate on understanding the materials and neglecting the requirements.

Illustration four

Our last illustration is David, one of the ten termers from LiU. As we can see, his expectations are more or less consonant with the education he has experienced:

> (David) More or less yes. I don't think I had expected anything. This was ... I ... I don't think I actually thought very much about how it would be ... before I started. So that way ... I wasn't surprised or anything.

In the following excerpt, David expresses his satisfaction with his education in general at the same time as he is critical of some of the aspects. His complaints concerns about the ambiguity and uncertainty in course content and goals, particularly during the early phases of the program:

> (David) ... I enjoy them. But I think they are very frustrating. At the beginning, the first terms were very frustrating because then nobody ... no one would say you should know this, you should know that ... you never knew ... what would be in the exam. It felt like ah ... this ... I mean it was this big a subject to ... to sort of digest ... and you knew that there was no way to do it ... and still you had to try and you don't know what way to ... to climb the mountain.

The goals become clearer, David says, in the clinical phase where he realized why they studied a particular content. He also indicates that he could easily relate to his future job:

> (David) But after a while you ... you realize you will never reach the top ... You will always be climbing. So those frustrating ... first ... first years were very frustrating, but now you learn to live with frustration. And also ... after starting the clinical practice ... then ... the goal is more ... more evident. You know what the reason is for your studies. I've been working for two summers and it's easier to relate as ... to relate to the ... to being a doctor. So now when I ... when I read I almost always see ... see a patient in front of me and think that way, so what should I do now, how to continue this research ... and when I ... when I know the diagnosis, what should I do then..

One of David's concerns is the fact that some of the areas are not sufficiently emphasized in the curriculum due to the departmental competition for time:

> (David) ... One thing that hasn't been well done, I think, but it also has been changed, because I was one of the first students to start ... ... it was ... microbiology ... and it's ... it has been a field that ... it hasn't been ... put in forward ... the first terms we studied ... It is included but not ... not in a very good way. Well, there is always enough time because time is the only thing we have as students ... ... but no one has showed us that ... microbiology is a central thing that you should start studying very early. There ha ... all the... all the other fields ... they have representatives on different committees ... and different faculties and they have been ... very much forward ... working for their subject ... but the people from the microbiology department they have ... they haven't been there ... in the way they should. They ... they didn't have the ... the strong man that certain other departments had. Things are ... I think ... maybe now it's better. For the students coming after us.

One of the things he is uncomfortable with in the clinic is the teachers' lack of time for taking care of what they should teach the students:

> (David) It is a bit frustrating that ... you always have to do everything yourself ... even if you have a schedule, you know what week you should be in what it's so much left up to you to ... to demand ... demand from the doctors that now you have to teach me, you have to show me this and to make different arrangements to go there, to go here ... and it takes so much time and energy. And then ... when the time is left for you to study, you're just too tired. That is the most frustrating thing right now ...

Another thing David is concerned about during clinical education is the lack of co-ordination between the clinical departments. He says that each has a perspective on their own area of interest and imparting this to the students but are not as well informed about the curriculum as a whole. This results in the students missing a great opportunity to receive an integrated picture of knowledge. They are left to synthesize a large amount of otherwise related knowledge as disparate information:

> (David) Mm ... I think that is the main crisis. Then also I ... I regret that some representatives for different fields, that they can't see the similarities ... between their subjects. For instance the eighth term ... when we studied ear, nose and throat diseases ... and ophthalmology and neurological diseases ... it all has so much with the ... the central nervousystem ... and that is the reason why they have been put together in the same term. And still the people from these departments have ... great difficulties in co-operating ... and there are so many opportunities to ... to co-operate ... and to see the parallels ... see the similarities. And it would be, I think of greater help to the students. Even though there are so many similarities ... you have clinical practice ... ah ... I think it was two days a week at the ear, nose and throat, two days a week at the ophthalmology ... and they were totally separated ... their lectures they ... they couldn't ... they didn't want to intrude on the other ... on the others business ... so even ... even though there are so many similarities and so many options to ... opportunities to integrate ... these different fields and ... I mean in one and the same case you can ... discuss different ... those three different ... different clinical fields ... but they are so much afraid that we will miss something in their separate field ... so if I'm discussing with the ... the professor of ophthalmology ... he ... he can't allow himself to ... to let us and himself discuss neurology ... even though if you have ... a cerebral in ... you can have only symptoms from vision. So even though the ... the reason is something within the brain ... you go to the eye, to the ophthalmologist ... and we're sitting discussing with him ... and he ... he can't discuss other things within the brain because that is the neurologist who should do that. So even if ... the big the whole term is these three fields ... there is no integration between them.

He is also critical of the training in general. Very often at the clinic, students are exposed to the most common paper-work or do the same training over and over again. David says that this yields nothing but a waste of students' time and is concerned that clinical skills or experience might be neglected:

> (David) ..., and it ... it varies between different clinics ... - One time you might have demands that you should do a lot of work within the

> ... you should ... do the ... paper work ... admitting and discharging patients.. and in the beginning that is ... it's ... it's good to do, because it's nothing that you're used to ... ... but after a while you know how to do it and you don't learn anything more from it ... and still you might have the ... have someone demanding that you should do it. Or being in the surgical ward you should assist during operations ... and the first time it's very interesting and you learn a lot, and the second time it's also very interesting, but the third and the fourth and the fifth time the same operation ... it doesn't give you anything more. Then you start feeling that OK, instead of standing like this ... and holding the things ... I could spend this time reading. Or I could be in the next room, looking at another operation that I haven't seen. So sometimes you ... you feel that they demand from you that you should do things that actually a paid doctor should do. Sometimes the demands are not ... they don't go together with the studies. But then for instance this term at the gynecology they say that OK, you should ... you should see two ... at least two or three different types of patients and ... admit them and do the paper-work ... but not more than that because it doesn't ... it doesn't teach you anything ... there's no more to learn from that.

When comparing the preclinical and clinical education, it appears that he is more content with the preclinical. This is in part due to the fact that teachers were more helpful then compared with now:

> (David) ..., Before that we had tutorial meetings with our tutors and also a list of people ... persons who we could call and they knew that they would be called by us and everybody ... they were very helpful. Now ... this supervision is done by clinical doctors ... who often don't have very much time, so often you have to intrude on their time ... on their time with patients ... so it is more or less up to you if ... if you get the supervision you want.

When talking about how he read the study task, it seems that he wanted to understand what the article was about:

> (David) OK, I started reading the introduction ... and after that I looked for ... also I looked to see who the author was ... I've forgotten that now, and I ... I looked for where it was ... published ... ... magazine ... and after reading the introduction I looked for a summary ... ... which did not exist. And then I just looked at the sub-titles. And then I read it all through. And made a lot of stops to ... to think if I understood ... I had to go back several times ... ... to ... to quite understand what it was.

But when he describes the way he dealt with the content of the article, it is more likely that he tried to understand the content of each section at a time and then add them up:

> (David) ... In the beginning I didn't ... I didn't quite understand what she wanted to say ... so I tried to ... to organize a bit more like ... eh ... doing some underlining ... and say OK, this is the first ... first part under this ... this subject she's talking about and then this is number two ... but after a few pages, then it was easy to follow ... what he was ... how he was presenting the subject.

When talking about PBL, he says it has both advantages and disadvantages. As regards the advantages of PBL, according to David, this way makes the program more interesting. He thinks that work in groups is stimulating and rewarding. Working in the tutorial group, according to David, helps the students to know what they already know and what they need to know. He then compares the way they study with the traditional way of learning and appreciates the way they study:

> (David) ... to me it is both ... both the stick and the carrot ... it ... it helps me to read, to study ... it makes it more interesting ... if ... I find it very difficult just being served, sitting at lectures and receiving knowledge. I want to ... to discuss, I want to ask questions myself ... and from problem-based learning ... working in these tutorial groups ... then you have the opportunity to ... to have a discussion and in that discussion, if it ... if everything works my way, so to speak ... then I have the opportunity to ... to sort of figure out what do I already know ... and what do I have to ... to find out. Because otherwise if I just sit down with a book, I never start thinking before ... what do I know of this subject already ... and what is it actually that I want to know.

Then he comments on the tutorial groups saying that the system encourages interpersonal interaction and gives the students opportunities to express themselves verbally. Although endorsing the tutorial group, he nevertheless indicates that sometimes there are problems in group dynamics due to the conflicts between individual interests:

> (David) But working in this tutorial group, I have already sort ... sorted a lot of things out. I have ... I have a purpose for reading that specific book going to that specific articl ... and also when it is a ... at it's best, then we have specific questions or maybe ... that we want to ... to find out does this ... prove or not. And then you have very much higher motivation ... to study. Well, working in a group there are different individuals, different ... different views about how things should work .. and some people they ... they like very much to have ... someone giving a lecture and have everything ... everything served to them, and also a lot of people find it very frustrating to ... to start discussing ... without having read that chapter in the book before ... but I find that very much rewarding because then ... then I ... then I know what I already know.

When describing his normal way of dealing with the learning materials, he stresses that he tries either to answer the questions he was supposed to answer or to read books to cover everything:

> (David) ... in the normal situation I don't use articles very much. I mainly read different textbooks we have ... and maybe in different subjects you find an interesting article ... but it ... eh ... the biggest part I read is from our textbooks ... and then ... usually ... since we work in these small groups ... we have ... we have a discussion ... based on ... on a case ... and we decide that OK, from this case we will answer these questions ... so that is one ... one reason for reading then ... and try to answer questions ... for the next meeting with the group ... and when I ... when I read for the next tutorial meeting ... then it's more

> like finding answers, looking in this book, reading a few pages there and then maybe go to another book and maybe look for an article just to ... to answer this specific question. But then of course ... since we're studying gynecology right now ... then I have to cover that field also. And then it's just ... like reading a book from the first to the last page, more or less. And when I read that way, I ... I try to think what is the most important and I underline. I don't take notes - But I guess I ha ... that's the two ... two different ways of reading I do, either answering specific questions ... or just reading through a large amount of material ... to ... to get a better overview.

Here, he explicitly indicates that he does not have any particular study skills:

> (David) ... I'm afraid I lack study technique. No, eh ... I try to ... to get time to read, not just sitting five minutes now, ten minutes then ... I want peace and calm around me and I want at least one hour ... so I know now I can concentrate on this ... but then ... unfortunately I must say, it's ... more less now that I try to read this book. Earlier when we didn't have as much time in practice, the clinical practice, then you could read in different places and you could sit in the library ... doing a lot of studying ... but now mostly I sit at home ... late nights ...

Commenting on whether or not he memorizes anything, he refers to things like symptoms:

> (David) Mhu, yeah. It is the patient says this and has these symptoms ... ... then I try to ... to memorize the different ... different possible diagnoses and which one I ha ... have to exclude before I can start treating. And also if it is this disease, what is the ... the treatment? It's like that. - Just go through ... in my mind try to make a list of them ... and then repeat them

When he was talking about the kind of questions he might pose to himself when reading the study materials, he said that if he does not understand something, i.e. the meaning of words he would look them up:

> (David) Yes, that is the ... that is the only type of notes I take when I'm reading. If I'm reading this text ... I mean almost every time you read a text there are certain questions that pop up in your head.. and then I write them down ... It could be just anything ... I don't understand this word, what is this word? What does it mean? And if I don't have a dictionary ... I have to write it down to go and look it up later on. Or ... it might be something that ... eh ... something I don't remember in physiology ... so I ... I make a short note about it and then I have to look it up later on. That's ... it's things like that ... different ... different questions ... it could be ... what type of medicine I should use there, what ... how to ... make that diagnosis or whatever.

When commenting on how he prepares for the examinations, he talks more about the kind of learning materials he gets information from, i.e. lecture notes, books, old examination questions. Because of the lack of time, he says, he has to start reading pretty close to the examination:

> (David) Then I read a lot. I look through ... all my ... my notes from the lectures ... and I also try to skim through the ... the various books and if there were any good articles that I've read during the term. But also ... since I don't have very much time to study ... during the term ... since clinical practice takes a lot of time ... often I ... read ... most of the stuff right before the exam ... and then ... often I'm quite surprised that ... oh, I ... I have already understood a lot of it, because we have been working with ... we have been discussing, we have had this clinical practice. So even if I hadn't read the book already ... It doesn't ... no. In the book there are not a lot of surprises. Usually we ... we meet two, three of us or three or four, and if there are lets say two weeks before exam we draw up a schedule and say: OK, for tomorrow we'll repeat these things ... and then we'll meet and have a discussion and then ... maybe we see each other every second day and also we use ... the old exams and look at those questions and discuss ... have those questions for discussion.

When reflecting on the kind of knowledge required for the examination, he stated that basically examinations evaluate understanding of the knowledge. There are sometimes, however, some questions on facts as well:

> (David) ... hm ... a basic understanding of ... of the reasons for different diseases ... understanding of ... what in the organism has been ... damaged or what functions have been changed, and how to ... different ways of making it right again ... So actually very basic things the ... the biggest part of the ... the knowledge that they require. And then of course more specific ... more specifically ... if ... if a patient has ... has this diagnosis, I should know the treatment and I ... the most common forms of treatment, the most common diagnoses I should know ... by heart. But then also ... from ... from a disease I should be able to ... to discuss more ... physiologically and microbiology and ... the more theoretically ... what is happening ... both to the ... to the organism but also to the small cells and ... mechanisms ...

When reflecting on the most important thing he had learned, he said that he had learned self-confidence and self-reliance:

> (David) ..., Mhm ... that's a big one ... I must think ... it's difficult to think of one important thing. The one most important. Some things I have learnt that is ... and they are very important is ... one to have confidence in myself ... and with that confidence also goes the ability to show that I am wrong ... or that I ... my knowledge has limits ... I can't ... I can't do ... everything ... and if I know that I have limits, then it's ... it's not difficult to ... to show other ... it might be patients, it might be colleagues or it might be friends ... but if I know my limits and also have confidence ... in myself within those limits ... then every personal encounter ... will be a benefit.

Comment

David is a student whose expectations almost coincided with the education he encountered. Generally speaking, he appreciates the teaching-learning system implemented at LiU. It would be uncomfortable for him, he states, if he had to attend passively to the teachers' exposition. According to him, there was a closer relationship between the students and teachers particu-

larly during preclinical phases where the teachers were very helpful and caring.

Working in the groups seems to be stimulating and supportive according to David. He generally appreciates the small group tutorials but also refers to problems that have, on occasion, impeded group dynamics. He is particularly critical of the ambiguity and uncertainty concerning the content and goals of the early courses. Another concern of his was the fact that some areas did not receive a sufficient amount of time in the curriculum, something that obviously has changed for the better in the subsequent courses. He seems to attribute part of this problem to the 'age' of the program saying that 'we were the first students in the system'.

His complaints are mainly about the clinical phase and revolves around issues such as teachers' lack of time, quality of training, lack of co-ordination between clinical departments as well as lack of time for studying. During the clinical phase, a tendency toward fragmentation due to specialization can be found in the curriculum, according to his comments.

His main intention, when dealing with the learning task used in this study and in general, seems to be towards understanding. But when he described how he read the article, he said that he read each section and tried to understand it and then went on to the next section and so on, which indicates applying an atomistic approach to learning. When he reflects on his study technique, he says that he does not have any particular technique.

As regards the kind of things he would memorize, he appears to concentrate on memorizing symptoms. According to David, the predominant concern of examinations is assessing understanding but factual knowledge is also measured.

He seems to think that 'self-confidence' and 'self-reliance' are the most important things he has acquired during university education.

Summary and conclusions

In this chapter we examined four subjects who provided empirical evidence for a better understanding of findings in general and some specific instances in particular.

The picture emerging from these illustrations corresponds quite closely to the one found in the description of the educational contexts regarding both PBL and traditional programs.

We observed from the two examples from GU that first of all the student from term ten was very dissatisfied with and critical of their education. This is particularly true where the curriculum in its early years has almost no objectives other than factual medical knowledge. To deal with this problem, the student tries to make the best of it by playing the system, through concentrating basically on satisfying the requirements of the system of assessment and being happy about it.

Clinical education and 'meeting with patients' brought about a change in his way of looking at things. He is still critical of the clinical phase, but now he acts in a different way. He reads more books now compared with the preclinical stage and he wants to learn whatever he is supposed to. Since the necessary training is not properly offered to them he develops a way of dealing with this difficulty by consistently demanding that teachers give him the kind of training he needs.

Another case from GU was a student from term five. Her expectations and the education not only match each other very well but also she found medical education easier than she had thought it would be. She perceives that examinations require both students' understanding of the knowledge as well as detailed factual knowledge. She takes into consideration these facts and gets along very easily with what is required by the system and her interest.

The subject in example three is a five termer from LiU. Here again we have one student whose expectations are consonant with the educational system. Contrary to the five termer from GU, this student seems to assume that evaluation of students' knowledge sometimes contradicts the underpinning philosophy of the program. According to the goals of PBL, examinations should emphasize understanding and the use of knowledge and skills from basic and clinical sciences, including the humanities, to evaluate understanding and managing patients' problems. Her comments on the way she studies in general and when dealing with the learning task, shows that she tends to apply a deep-level approach to the learning material.

David is our last subject. He is a ten termer from LiU. From his interview it seems that the educational context almost met his expectations, particularly during the preclinical phase. He is not receiving the kind of training he expected during the clinical phase. Clinical teaching is uneven due in part to the fact that it occurs in a large network of hospitals and clinical faculties which are heterogeneous in nature and as to teaching abilities of their staffs. It seems that many clinical wards fear that an omission of a particular piece of knowledge may cause irreparable damage to the students' education. He appears to assume that some of the difficulties have to do with the age of the program.

Students start their university education with different expectations. Some expect that higher education will be different from the upper secondary school. They will be given more freedom to deal with their studies. The program will develop intellectual questioning among the students and so on. Other would prefer to continue their university education in the same way as was in their upper secondary education. They do not want any changes. They feel more secure and safer with the way they were taught and learned and want to continue in this way.

The LiU program seems to provide this transition between the two levels of education from an early stage. It encourages personal development among the students. It creates an atmosphere that is supportive and stimulating. Unfortunately, the clinical phase fails to realize these principles.

GU, on the other hand, does not bring about any changes. As we have seen, this caused much disappointment among those who expected that 'the education would be academic'. This is particularly true at the preclinical stage where, as we have seen from both the description of the curriculum and the interviews, it is a continuation of the upper secondary school. The clinical phase differs somewhat. Here, for the first time students are confronted with patients and their problems. Now everything makes more sense and a more comprehensive image of 'what it is really all about' emerges. From what these four students expressed regarding the different issues under scrutiny, it seems that there is a clear distinction between LiU and GU program as a whole. The comparison favours LiU in several respects. But there is, however, an unfortunate impediment in the case of the LiU program in that the differences within the PBL program are negative whereas the opposite is the case when it comes to the GU program.

Chapter 16

SUMMARY AND DISCUSSION

This chapter starts with a brief summary of the results of the empirical study, which will be followed by a discussion of the findings.

Summary of the results

In this section, the outcome of the content-oriented questions, students' approach to learning in the conditions provided in the study and their approach to learning in the normal daily study situation, and students' experiences of university education will be summarized. The second part of this chapter consists of a discussion regarding the findings and how we can develop a more sensitive design to study the impact of PBL programs.

As has already been pointed out (see chapter 1), demands for the advancement of medical education have grown stronger in recent decades. It was believed that medical education is subjected to a continuing deterioration. Among several suggested measures which tried not only to arrest this accelerating erosion but also to improve the quality of medical education, PBL gained a special position in the medical education community. The Faculty of Health Sciences at Linköping University in Sweden is among those to have adopted this program since 1986. Among many others, students' learning as well as their conceptions of educational environment, are the objectives which have been focused upon by the curriculum implemented at the Linköping Faculty of Health Sciences. Consequently, it is of interest to see what, if any, differences there are between the students from this faculty and a traditional-discipline based program in this respect. Moreover, this research should be considered as an empirical contribution to examining the effectiveness of PBL. It is against this background that the present study was accomplished.

Conceptions of the reading task: Approach and outcome

A scientific article served as a trigger in the interview procedure (see chapter 7). The opening four questions in each interview session, thus, were about the content of the article. The first question in this respect required the students to very briefly express the main points the article wanted to convey. The analysis of the answers yielded three categories which were different from one another in terms of completeness.

The second content-oriented question asked the students to give a free recall of the content of the article. The third question aimed at penetrating students' conceptions of the causes of capillary growth. The final question

in this group, although not directly dealing with the content of the article, is nevertheless included here. In this final question the students were asked to express their thoughts about the relationship between biomedical knowledge and the medical field as a whole.

As was indicated in the design section of the study (chapter 7), after answering a set of questions on the content of the article, the students were required to describe the way in which they read the article.

The analysis of the answers to the first question, which asked students to describe how they read the text, shows that the students approached the reading material in four qualitatively different ways. The students either used; A. An investigative approach to learning; B. A comprehension-directed learning approach; C. An atomistic approach; or D. A study technique-directed learning approach. One third of the answers belong to the D category, where the majority of the answers came from the GU students. The B category comprises twenty nine students who are almost equally distributed over the two university groups.

The second question in this domain required the students to describe the kind of techniques they used when reading the article. The analysis of the answers resulted in two qualitatively different categories. A. A non technical-directed process of learning, B. A technical-directed process of learning. The answers in the A category are almost equally distributed over the two groups of students from the respective universities. Twenty eight answers fall into the B conception, eighteen of them are from GU students. Fifteen remaining answers belong to the ignorant category.

It is interesting to note that, as regards the A conception, there are about twice as many ten termers from LiU as there are five termers, whereas the pattern is the opposite in the B category. In the case of the GU students, the pattern is the opposite, i.e., there are more five than ten termers in the A category and twice as many ten as five termers in category B.

The last of a set of questions, which required students' descriptions of the way of dealing with the reading material, concerned the kind of associations made while reading the article. The analysis of the answers yielded three different categories as far as the nature of the associations are concerned. These associations are: A. Content-oriented associations, B. Context-oriented associations, with just above half of the answers or, C. Extra-content extra-context associations. Ignorant answers comprise two answers.

Students were also given a set of questions designed to uncover how they approach learning materials in the normal study situation. The first of these questions asked the students whether they pose themselves any questions when reading study tasks. The analysis of the answers appeared to be of the following variety; A. I ask critical/analytical questions; B. I ask myself if this information is relevant; C. I ask myself if there will be any question on this in the examination; D. I ask other people if I do not understand what I read; or E. I do not ask any questions.

The second question asked the students whether they memorized certain things more than others. Their comments were analyzed and the results indicated that students either said; A. I want to understand what I read or I memorize the important things; B. I memorize facts, figures and names; C. I memorize what interests me; D. I memorize what is important for the exam; E. I memorize what was said in the lecture; or F. Combinations of several aspects.

In the last question, the students were asked to describe how they prepare themselves for examination.

GU students appear to rely heavily on lecture notes while studying for exams. Ten termers from both universities seemed to read text-books more than five termers in general. This is, however, not the case during the preparatory period for the tests.

Old examination questions are of special interest to all groups of students. There is, however, a difference between the students when it comes to the reason for using these questions. For the LiU students the purpose is more likely to get acquainted with the level of the exams whereas GU participants seem to use them to be able to better pass the exams.

Some of the LiU students appear to look at the goals for the term first and then start studying when preparing for the exams whereas this issue was not mentioned by GU participants.

Another question required students to describe what kinds of knowledge are emphazised in the examination tasks. The analysis of the answers showed that: A. The emphasis is on understanding; B. Examinations contain various types of tasks; C. The emphasis is on detailed knowledge.

In category A there are thirteen answers, all given by LiU students, whereas of the thirteen answers in the C category, only one comes from a LiU student. Category B, with just above half of the answers, includes almost an equal number of students from the two universities.

In order to find out what, if anything, besides the formal goals of the curriculum is learned by the students during the period of time they spent studying medicine, the students were asked to describe the most important thing they learned. The meta-categories describing the nature of knowledge are as follows; A. I have learned that knowledge is lacking or only provisional; B. I have learned to communicate and co-operate with other people in a respectful way; C. I have learned to value life; D. I have learned to take care of myself and/or others; E. I have learned self-esteem; F. A combination of conceptions; G. Residual category and H. Ignorant answers.

The students' experiences of university education

Another domain of inquiry in this study concerns how students had experienced their university education. The opening question in this domain is broadly formulated and asked for the interviewees' spontaneous thoughts with respect to their experience of the university/faculty.

Since the answers were of assessing in nature, they were analyzed on the basis of both their content and attitudinal components. As far as the former component or the content of the interviews is concerned, seven aspects of the medical education were highlighted in the discussion. These aspects are; A. Teaching/learning; B. Continuity between different parts of education; C. Teachers' attitudes; D. Clinical education; E. Personal; F. Workload/Time constraints; G. Combinations of aspects. Teaching-learning aspects are the most common issues focused on by half the students.

As for the latter component -students' attitudes concerning the various aspects, three kinds of attitudes manifest themselves in the interview material. The students have either positive, partly positive or negative attitudes as far as these aspects are concerned. There is, however, a substantial difference between the two groups of students when it comes to their attitudes towards different aspects of university education. LiU students, in general, are more likely to have enjoyed their university education (sixteen pleasant experiences, six partly satisfied and eight with unhappy feelings), whereas this was not a case for GU participants (nine had a positive, three a partly positive and eighteen a negative view of their education).

In order to see to what extent students thought their expectations of medical education were met in reality, they were asked to express their points of view about this matter. An analysis of the answers aiming at describing these expectations yielded the following: A. No expectation; B. Yes/more or less; or C. No. The result showed that LiU students experienced a better education compared with their expectations, whereas GU students' experiences were much less satisfactory than their expectations.

One question, which was given only to the LiU students, concerned the students' standpoints about the PBL program. No corresponding question was posed to the GU participants. An overwhelming proportion of the answers are primarily value statements. Only three students spontaneously think about PBL in objective terms. The value-oriented answers are of different kinds; A. PBL means self-directedness in study activities; B. The importance of real life situations; C. The importance of work in the group; D. Combinations of conceptions; or E. Definition answers.

In chapter fifteen, four individual students were described in detail.

Discussion

PBL originated as a result of and a solution to recognized weaknesses in medical education. It was pointed out previously that many pedagogical principles are embodied in the curricular structure of this approach. The program is designed to meet the needs of the student. Curricular content is carefully chosen and presented through different problems. By creating a proper environment, students are encouraged to become active participants. Frequent feedback to the students is strongly emphasized. Another and very important consideration in the PBL program is the flexibility and willingness to change through ongoing program evaluation and curricular modification. To date, there are unfortunately few outcome studies and among the available studies, few clear-cut advantages or disadvantages of PBL compared with the traditional program have been demonstrated.

Undoubtedly, in designing comparative studies one encounters certain practical constraints regardless of whether it is the evaluation of the effectiveness of PBL or other educational programs. In this case, evaluating the educational outcomes of PBL several formidable problems such as definition and operationalization of PBL, student selection policy, cross contamination of experimental cohorts, hidden curriculum, age of the program and expense of evaluations, among many others, are problems which have to be considered.

A review of some of the studies tried to investigate different educational outcomes of PBL program indicated the followings. For one thing, in the assessment of the students' knowledge, premises guiding these kinds of studies are incongruent with the view of learning and knowledge embodied in a PBL curriculum or any other curricula that have respect for these principles, for that matter. In other words, in these studies no consistency of philosophy and evaluation was preserved.

In studies where scholastic achievement is assessed, multiple-choice tests are considered to be the foremost tools of assessment. Though not inherently without value multiple-choice tests are viewed as unfortunate and incompatible with any evaluation of students' comprehension and ability to reason analytically. The results of these studies, however, as has been described previously (see chapter 4), showed that sometimes students from PBL seemed to perform better compared with their counterparts from the conventional curriculum and at other times the reverse was the case. Some studies showed no difference with regard to this issue.

In regard with investigating the students' experiences of and attitudes towards medical education, the researchers basically selected different aspects of the educational program and asked students to express their opinions about them.

Observing these studies pointed to the necessity of developing alternative research approaches if the inquiry is to contribute to an understanding of how students learn and assess their educational programs. In other words, if we are to gain useful results and new insights with regard to

examining different educational outcomes of the PBL curriculum, we need alternative methods of inquiry.

The present study should therefore be considered as an empirical contribution to not only studying the outcomes of a PBL curriculum, but to the variety of research methods in the area as well.

As we saw previously when presenting the results of the content-oriented questions (see chapter 8) we attempted to see how students understood the content of the learning task by posign three questions. The results of the first question - the summary of the main points of the article - showed that students' answers were either of a conclusion-oriented, descriptive, or mentioning nature.

The results of the free recall also showed three types of understanding of the content. The best answers were those where the students described the factors involved in capillary growth but also differentiated between the growth of capillaries in the heart and in the skeletal muscles. The 'B answers' exclude this differential aspect of the answers. In the 'C answers' students content themselves with just referring to some factors involving in capillary proliferation.

As for the results of the conceptions of causes of the capillary growth, the answers indicated that there were three ways of reasoning. The answers in the 'A category' not only included all aspects concerning this phenomenon presented in the article but also included some of the aspects not given in the text. This way of reasoning resembles with what Bigg and Collis (1982) termed *'Extended abstract'*.

The B and C conceptions, on the other hand, include the answers in which students only took up one or several aspects dealt with in the article. In this respect, these answers also to some extent remind us of the *'Relational'* level of the taxonomy of knowledge presented by Biggs and Collis (1982).

Inspired by the two popular theories of the time, piagetian developmental theory as well as information processing theories, Biggs and Collis (1982) tried to establish an empirical classification of levels of learning outcome. This led to the establishment of a so-called SOLO taxonomy (the Structure of the Learning Outcome). The taxonomy drew its support from the observation of students' range of answers to a specific question. Generalizing beyond the original example, they soon argued that this general structural analysis of the outcome of learning is applicable to measuring any learning outcome irrespective of the content to be learned or the form of question to be asked. The taxonomy has the following categories:

1. Prestructural. The answers belonging to this category show no indication of understanding of the learning material but contain only isolated facts.

2. Unistructural. The answers include one aspect of the data.

3. Multistructural. The answers comprise several independent aspects of the learning material.

4. Relational. These answers include most of the interrelated data and students relate them to their prior knowledge and experience.

5. Extended abstract. This category of answers is the one which not only includes the information presented in the text but also incorporates other aspects not present in the learning material.

However, the results of the questions mentioned above showed a similar pattern of answers among the students. As a whole neither inter nor intra group differences were demonstrated. No study of the type carried out in the present investigation has ever been conducted. In this sense, we have nothing to compare our results with. Compared with the results obtained by other researchers attempting to evaluate the level of knowledge of the PBL students and that of students from a traditional medical school, our findings show no difference in this respect. That is, the difference between students' knowledge is small or non-existent. In some studies, PBL students perform better than students in traditional programs, in some cases, the difference goes in the opposite direction.

It had originally been hoped that the PBL curriculum provides a setting in which students not only enjoy their learning activities, become active participants but also develop humanistic attitudes. The fact that the framework of institution, department and courses and system of assessment affect students' perceptions of different learning activities and how students' perceptions may influence their approaches to learning is well-known today (Ramsden 1979; 1984).

> Students do not, for example, simply read an article. They read it for a purpose connected with a course of study and in response to the requirements of those who teach the course. ..., The realization that university teaching context might have unintended consequences for learning - that they might encourage students from coming to grips with fundamentals of their subject and encourage them to use tricks and stratagems to pass examinations - is certainly not a recent one (Ramsden, 1984, pp 144, 145).

Generally speaking, it is more difficult to measure these aspects (non-cognitive aspects) than the cognitive ones. This difficulty is compounded if one tries to approach the former aspects inappropriately. In order to understand with confidence how students perceived these former aspects of the curriculum, the best thing to do was to let the students speak for themselves. In the present investigation, the students were given the opportunity to do so by asking them simply to express their experiences of the university/faculty during their years of study. As we saw earlier, the teaching-learning aspect is typical of a comparatively large group which contains

both negative and positive opinions. Several other aspects of university education were also commented upon by the students. The final results showed that in general LiU students have had a more enjoyable education compared with their counterparts from GU. Our findings are thus in line with the results of other studies as regards the direction of students' attitudes towards the curriculum. When it comes to the nature of these aspects, however, there is a variation between them. The aspects talked about in the present study are the ones which the students thought were significant to them whereas in other studies, different aspects were chosen by the investigators and required students to comment upon them.

Similar comments apply to the attempt made to depict PBL students' reflections on this program. In this case as well, the aspects commented upon were brought up by the students themselves. Self-directedness in study activities the importance of real life situations and the importance of work in the groups were the three aspects of the program respected most by the students. There is, however, a difference between the ten termers, and the five termer's points of view pertaining to the two latter aspects. The last aspect is typical of the ten termers whereas the importance of the real life situation is typical of the five termers. Self-directedness, as we saw earlier, is considered to have been appreciated by an equal number of students from the two levels of education.

As far as the approaches to learning are concerned, our results are similar with the results of previous comparative studies (Coles 1985; Newble & Clarke 1986; Newble & Gordon, 1985). Both our results and findings from other investigations favour the PBL program in that students from a PBL curriculum apply a deep approach to a greater extent than students from a traditional medical school.

With regard to learning approach and its relation to learning outcome, our findings would seem to be somewhat paradoxical in that although the PBL students appear to have been using a deep approach when dealing with study materials they nevertheless achieved similar learning outcomes as did the GU students, whereas the reverse would have been expected (Svensson, 1976).

Several explanations other than the influence of the different educational environments involved are possible for these results. One initial explanation could be that in PBL program strong, explicit emphasis is placed on teaching and directing the students toward certain ways of approaching the study materials. This emphasis may lead the students to perceive that they are expected to behave in a certain way when it comes to the learning process. They are also more conversant when it comes to describing these issues. Such motives seemed to be lacking for the other students.

Another explanation could be students' previous study habits. Given that the students mostly come to university right after finishing their secondary education, perhaps it takes more time than one would expect to wash away the effects of several years of studying which one has been

accustomed to and adopt a new pattern of learning. It could be argued that we do have the indirect evidence to prove that students were used to applying a surface approach before coming to the university. As was mentioned previously (chapter 13), students were critical of their secondary education due to the fact that it directed students towards rote learning not understanding.

Some excerpts:

> (P4) Yes, I mean it's quite like Swedish upper secondary school, it's not very different. I mean there are a lot of lessons and people who show you what to do. ..., I think there's too much of that. I mean the lectures are good and the teachers are very good, but I think you should have more time for self-studies.
>
> (P18) Too often the early years are only the continuation of upper secondary school it is just like one should read a lot of theoretical knowledge ...,
>
> (P24) ..., well I thought it was perhaps ..., I didn't think it would be so much like upper secondary school ...

Another explanation, could be that students from a PBL medical school are more inclined to apply the deep-level approach at the lower level of the education (preclinical years). A deep-approach to learning as defined by Marton and Säljö (1984) consists of two kinds of intentional components. When reading a text, students attempt to find the points the author wanted to convey as well as to evaluate the content critically. In this respect, when dealing with learning materials, five termers appeared not only to try to understand the content but also to evaluate the content critically whereas the main concern of the ten termers seems to be understanding the content of what they read. In a sense, it seems that the critical/analytical attitude toward study materials fades away and a major interest for ten termers when dealing with the study tasks becomes understanding the content although they do not evaluate their understanding. There is empirical support for this assumption in the study. This is evident in chapter 9 where the results of the question about the approach to the learning task are presented. In answering the three questions with regard to this issue, LiU five termers on two occasions applied a deep-approach more than ten termers. As regards the question: *"How did you read the article? "* there are more five termers than students from term ten in *"An investigative approach to learning category"*. With respect to the question on the associations, more answers from five termers belong to *"The content oriented associations category."*

With regard to comprehension of the content of the article, LiU five termers often performed slightly better than the ten termers or as well as the ten termers in GU. At GU the development is often opposite to that at LiU. Some examples: in answering the question pertaining the main points

of the article, five termers from LiU and ten termers from GU performed equally well.

One could reasonably ask why this is the case. A set of plausible causes will be discussed. One explanation could be the relatively short period of experience of the PBL program and the so-called 'child diseases' which are involved in implementation of almost any new program. Our ten termers are the fourth cohort of students studying in the PBL program. Most probably, there have been many unforeseen changes in the program that affect its outcome. Actually, when talking to the LiU ten termers, some of them said that the version of PBL the new generation of students is exposed to is not similar to the PBL implemented when they started studying medicine, or as another student expressedit: ..., ... *when we ... started the program ... it wasn't finished, it wasn't ready.* ..., *I think it's getting better all the time.* or as another students said; *So far I think it's avery young faculty.*

But in this context I would also like to refer to what has been denoted as *technification* and *hyperintention*. (Dahlgren, 1975).

Dahlgren (1975), in an attempt to examine the influence of the experimental manipulations on the students' learning process, compared two groups of university students (thirty-eight participants) equally divided into one control group and one experimental group. They were given a text of 45 pages consisting of two chapters. The experimental manipulations were made when reading the first chapter and their effects were assessed in the second chapter. The findings indicated that experimental manipulations had slightly negative effects on retention of the first chapter and a positive influence on learning the second chapter.

Dahlgren argued that this might have been the result of what he called *t*echnification, i.e. paying too much attention to satisfying the demands made on students to study in a certain way, or hyperintention, i.e. spending too much effort on doing one's best.

However, applying a contextual analysis seemed to be reasonable when trying to explain and understand the results. As was said previously, contextual analysis is an expansion of phenomenography. It has been developed to take care of the eventual differences between the categories of conceptions emerging from the empirical data. The main aim of this method of analysis is to link the students' conceptions with the description of the learning context to provide a possible explanation and understanding of the results.

The contextual analysis suggests that the principle intention of the PBL program is to create a *holism* in the course of education. The strongest justification given by founders of PBL for this program is that PBL is a pedagogically powerful curriculum. The foundation for these valuable principles is laid in the preclinical stage. It had originally been hoped that the subsequent levels of education would benefit from them (see chapters 1 and 2). Also the general objectives of the clinical education are in accordance with the spirit of the program. One thing we should realize, however,

is the fact that clinical education occurs in the setting of individual specialties. This implies that the intention of the program may be difficult to translate fully into practice during clinical clerkship, in part because of these impediments. This means that the global perspective that PBL program starts with during the early phases may change into a rather partial one during clinical education and also because that is how clinical services traditionally are. There is much evidence showing, in the past as well as in the present study, how students are quick to align their learning activities with what they perceive are required of them. It is likely that the necessity of submitting to both the intention of the program and the reality of the clinical services obscures the impact of PBL.

One may ask on what basis we can make such a claim. Our claim can be substantiated by the statements given by the students from term ten. We have seen previously, when presenting the results of the students' experiences of their medical education, that some of the LiU ten termers were unhappy with and critical of the clinical education. The nature of their critiques could be as follows:

> (P46) Hm, The clinics still look at us as they did with the older students who had all these lectures and didn't have to read as much, so they won't understand if we say that we need time to read.
>
> (P48) ..., ..., that we don't get the guidance we need.

A pattern emerged in the specific parts of the results. In the detailed description of the four interviews, there is empirical support for the claim generated from the analysis of the educational context in that the students report impressions consonant with the hypotheses based on scrutiny of the curricula. The PBL program provides the students with an education which is congruent with the goals of both higher education and medical education. It brings about a proper transition from upper secondary education to higher education whereas the GU programs fail in this respect. Students at GU and LiU are entering clinical phase which are very much the same. However, they arrive there with differing experiences from previous stages of their education. The LiU students have previously been encouraged to study within a holistic perspective, to formulate their own questions and to approach these from various perspectives. The GU students, on the other hand, have a prehistory of literary disciplinary thinking and are used to establishing a body of knowledge primarily consisting of basic facts within the disciplines. Clinical education helps the GU students to obtain a fairly integrated perspective of patients and their problems. For the LiU students, on the other hand, this is the time to put into practice the integrated perspective of patients they have already obtained. Unfortunately, this is not realized due, among others, to the variability of the clinical services which are not educational-oriented and also because this is the way most hospitals at academic medical centres are organized. The incongruity between how LiU students are taught on the one hand, with the goal of preparing them to

be life-long learners capable of critical analysis and so on, and the reality of the praxis on the other may contribute to levelling out the impact of the PBL approach.

The present inadequacy in measuring PBL's educational objectives may partly emanate from our primitive understanding of what constitutes the different objectives PBL promised to foster among the students. Hence, the development of methods of assessing complex skills is an area of utmost importance.

I would like once again to emphasize the fact that in order to not only examine the effectiveness of the PBL but also improve its effects, we will have to continue the research into the nature of these effects of course, from students' perspectives.

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Medical Education in Linköping University

Phase 1

Term I

Man and Society Integration between 5 Health Education 9.5 W		Locomotion Skin 9.5 W	Ex 1 W

Term II

Nutrition, Digestion and Metabolism Hormonal and Neural Regulation 15 W		Blood 4 W	Ex 1 W

Term III

Reproduction 4 W		Respiration Circulation Renal System 14 W	Ex 2 W

Phase 2

Term IV

Hormonal Regulation 3 W	Locomotion and Skin Nervous System Sense-Organs 7 W	Respiration Circulation 9 W	Ex 1 W

Term V

Elective 3 W	Nutrition Digestion Metabolism 9 W	Blood 4 W	Renal System Reproduction 5 W	Ex 2 W

Phase 3

Term VI Rotating clerkships each term (except XI)

Internal Medicine 12 W	Dermatology Infectious Diseases 3 W	Primary Care 3 W	Ex 2 W

Term VII

Surgery orthopedics 12 W	Anesthesiology Intensive Care 3 W	Primary Care 3 W	Ex 2 W

Term VIII

Neurology, Ophtalmology Oto-Rhino-Laryngology 15 W		Primary Care 3 W	Ex 2 W

Term IX

Psychiatry 9 W	Geriatrics 3 W	Internal Medicine 3 W	Primary Care 3 W	Ex 2 W

Term X

Pediatrics & Child Psychiatry Gynecology & Obstetrics 12 W	Dermatology Infectious Diseases 3 W	Primary Care 3 W	Ex 2 W

Term XI

Elective 10 W	Community and Environmental Health 6 W	Ex 4 W

Ex = Examination W = Week

Medical Education in Gothenburg University

Year 1

Term I	Term II
Introduction Medical and Physiological Chemistry Cell Biology 19 W	Anatomy and Histology 21 W

Year 2

Term III	Term IV
Medical and Physiological Chemistry Medical Physics Nervous System 17 W	Biostatistics Physiology Medical Microbiology Clinical Microbiology 20 W

Year 3

Term V	Term VI
Pathology and Genetics Pharmacology 20 W	Medical Psychology Medical Examination Methods Clinical Physiology Clinical Chemistry General Internal Medicine Infectious Medicine 20 W

Year 4

Term VII	Term VIII
Infectious Medicine General Internal Medicine 19 W	Surgery 20 W

Year 5

Term IX	Term X
Psychiatry Geriatrics Dermatology Community, Environmental and Forensic Medicine 21 W	Radiology War and Catastrophe Medicine Ophthalmology Oto-Rhino-Laryngology Neurology Primary Health care 20 W

Year 6

Term XI
Neonatholog, Pediatrics Obstetrics and Gynecology Child and Adolescent Psychiatry 20 W

Ex = Examination W = Week

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